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(54) [Name of the Invention]

FLUORESCENCE OBSERVATION APPARATUS

(57) [Abstract]

[Purpose]

To improve diagnostic ability by improving the quality of a fluorescence observation image of an area to be observed by increasing the intensity of fluorescence image.

[Summary of the Invention]

A fluorescence observation apparatus is provided with a fluorescence image processing apparatus 24 which processes the fluorescence image of an observed area that has been irradiated with an excitation light.

The fluorescence image processing apparatus 24 comprises:

frame memories 53 and 54 for storing fluorescence images inputted in a time sequence;

a motion compensation circuit 55 for performing the motion compensation of fluorescence images by

detecting the image motion vector of the fluorescence images stored in the frame memories 53 and 54; and an integration circuit 56 for integrating the motion-compensated fluorescence image stored in a frame memory 57 with the image in frame memory 58. After a specified number of integration, the image is outputted and displayed on a monitor as fluorescence observation image.

[Claims]
[Claim 1]
A fluorescence observation apparatus with a light source device for fluorescence observation that generates excitation light for exciting fluorescence from an observed area and an image detecting device for fluorescence observation which acquires a fluorescence observation image of the observed area, the fluorescence of the observed area being) the result of the excitation light from the aforementioned light source device for fluorescence observation, is provided with:
an image motion compensation device for performing the image motion compensation for several fluorescence images obtained during a time sequence from the aforementioned image detecting device for fluorescence observation; and an integration device for integrating the several fluorescence images which have been motion-compensated by the aforementioned image motion compensation device. The image integrated by the aforementioned integrating device is displayed as a fluorescence observation image. The fluorescence observation apparatus is characterized by the description above.

[Detailed explanation of Invention]
[0001]
[Technical Field of the Invention]
This invention relates to a fluorescence observation apparatus which irradiates to an observed area on organism's tissue with excitation light and observes the fluorescence image emitted from the area irradiated by the aforementioned excitation light.

[0002]
[Prior Art]
In recent years, techniques such as auto-fluorescence, which is generated directly from living tissue by irradiating the excitation light to an observation area of living tissue, and drug-induced fluorescence, which is generated by injecting a fluorescent drug into the organism beforehand, produce two-dimensional images which are used to diagnose the degeneration of tissues of the organism or a state of the disease (for example, the type of the disease or the extent of infiltration), such as a cancer. This fluorescence observation apparatus has been developed to perform such fluorescence observation.

[0003]
In auto-fluorescence, if excitation light irradiates living tissue, the wavelength of the fluorescence generated will be longer than that of the excitation light.
Fluorescence substances in the organism are, for example, collagen, NADH (nicotinamide adenine dinucleotide), FMN (flavin mononucleotide), pyridine nucleotide, etc.
Recently, the interrelation between these substances in the organism emitting fluorescence light and diseases is becoming clear, and the diagnosis of cancer, etc. is possible from this fluorescence.

[0004]
Alternatively, a fluorescence substance such as HpD (hematoporphyrin), Photofrin, ALA(δ-amino levulinic acid), etc., may be injected into an organism. These substances have a tendency to accumulate in cancerous tissue, and a diseased area can be diagnosed by observing the fluorescence after injecting any of these substances into an organism. Moreover, a fluorescent substance can be added to a monoclonal antibody and accumulate in the diseased area by the antigen-antibody reaction.

[0005]
As an excitation light, a laser light such as that from excimer lasers, krypton lasers, He-Cd lasers, or dye lasers are used. The fluorescence image of an area to be observed is obtained by irradiating living tissue with excitation light. By detecting the dim fluorescence, generated from the living tissue being irradiated by excitation light, a two-dimensional fluorescence image for observation is formed for observation and diagnosis. In an organism's tissue, the intensity and spectrum of fluorescence light changes between a normal area and a diseased area. By detecting and analyzing a part of the intensity and spectrum of fluorescence light, normal tissue and abnormal tissue such as cancerous tissue can be distinguished and malignant areas can be determined.

[0006]
In the unexamined patent number H05-304429 gazette, the same applicant has proposed a fluorescence observation apparatus capable of identifying lesions by detecting a fluorescence image from an organism's tissue irradiated with the excitation light by the wavelength λ_0 (442nm, for example) using an endoscope, etc. and by acquiring two fluorescence components (λ_1 = 480 – 520nm and λ_2 = 630nm and over) having different intensities of

fluorescence in normal tissue and diseased tissue and by performing calculation, such as the difference or ratio of the fluorescence image signal acquired in λ_1 and λ_2 and by using a pseudo-color display which displays a normal area as green and a diseased area as red based on the result of the calculation using the fluorescence image signals.

[0007]
[Problem to be Solved by the Invention]
In the above-mentioned fluorescence observation apparatus, the fluorescence obtained from the organism's tissue of the area to be observed has weak fluorescence intensity so that an excellent fluorescence observation image may not be acquired depending on the condition of the area to be observed. Thus, it may cause a misdiagnosis during the fluorescence diagnosis such as overlooking a diseased tissue or making wrong determination of a normal and diseased area, and there is a problem of the deterioration of fluorescence diagnosis capability.

[0008]
This invention is formed in consideration of the above mentioned matters. The purpose is to provide a fluorescence observation apparatus capable of improving diagnostic performance by improving the image quality of a fluorescence observation image of an area to be observed by improving the intensity of the fluorescence image.

[0009]
[Means to Solve the Problem]
A fluorescence observation apparatus with a light source device for fluorescence observation that generates excitation light for exciting fluorescence from an observed area and an image detecting device for fluorescence observation which acquires a fluorescence observation image of the observed area, the fluorescence of the observed area being) the result of the excitation light from the aforementioned light source device for fluorescence observation, is provided with:
an image motion compensation device for performing the image motion compensation for several fluorescence images obtained during a time sequence from the aforementioned image detecting device for fluorescence observation; and an integration device for integrating the several fluorescence images which have been motion-compensated by the aforementioned image motion compensation device. The image integrated by the aforementioned integrating device is displayed as a fluorescence observation image.

[0010]
[Operation]
The excitation light generated by the fluorescence observation light source device irradiates an area to be observed, and then a fluorescence observation image of the area, resulting from the fluorescence excited by the aforementioned excitation light, is detected by a fluorescence observation detecting device.
Then, the image motion compensation is performed for the several fluorescence images obtained during a time sequence by the aforementioned fluorescence observation detecting device, and these motion compensated fluorescence images are integrated by the integration device and displayed as a fluorescence observation image.

[0011]
[Embodiment]
Hereafter, embodiments of this invention will be explained referring to drawings. Fig. 1 through Fig. 4 relate to the first embodiment of this invention. Fig. 1 is a schematic diagram showing the overall structure of a fluorescence observation apparatus. Fig. 2 is a characteristic diagram showing the spectrum of fluorescence on an area to be observed of organism's tissue. Fig. 3 is a block diagram showing the functional structure of a fluorescence image processing apparatus. Fig. 4 is a timing diagram explaining the operation of the fluorescence image processing apparatus.

[0012]
A fluorescence observation apparatus according to this embodiment comprises an endoscope 1 for introducing excitation light into an area to be observed and for forming an image of the fluorescence light emitted by the area. The fluorescence endoscope apparatus further comprises: a laser beam apparatus 2 which contains a device to generate a laser beam, such as a He-Cd (helium-cadmium) laser which produces a 442nm wavelength violet [actually, blue] light, an excimer laser which produces a 350 – 500nm laser beam, a krypton laser, or a dye laser; and a lamp light source apparatus 3 having a lamp 3a, such as a xenon lamp, for generating white light such as that produces by a as a normal observation light source.

[0013]
A light guide 4 for transmitting light emitted by the laser beam apparatus 2 or the lamp light source 3 to the endoscope 1 tip and an image guide 5 for transmitting an image to an ocular portion 6 are contained in the endoscope 1. The light guide 4 is inserted into a universal cord 7, which is extended from the handle part of the operator end of the

endoscope and terminates in a light guide connector 7a located at an end of the universal cord 7.

[0014]
The laser beam apparatus 2 and the lamp light source apparatus 3 are connected to a light-distribution adapter 8 for switching light to be introduced into the endoscope 1. The light guide connector 7a of the endoscope 1 is connected to the light-distribution adapter 8. Thus, excitation light emitted by the laser beam apparatus 2 or normal light from the lamp light source apparatus 3 is introduced into the light guide 4 of the endoscope 1 through the light-distribution adapter 8 and transmitted to the endoscope tip.

[0015]
The light-distribution adapter 8 has an illumination light switching device 11 comprising a movable mirror 9 placed in an optical path for light emitted by each light source apparatus and a driver 10 for operating the movable mirror 9. By selectively switching the movable mirror 9, excitation light or normal light can be introduced to the end of the light guide 4.

[0016]
A light-receiving adapter 12 is connected to the ocular portion 6 of the endoscope 1. A normal-light camera 13 and a fluorescence-light camera 14 are connected to the light-receiving adapter 12. Thus, each imaging device is able to acquire a normal image and a fluorescence image.
The normal-light camera 13 has a CCD 15 which serves as an optical sensor to capture an image of an observed area (normal image) which has been irradiated with normal light emitted by the lamp light source apparatus 3.

[0017]
The fluorescence camera 14 comprises a drive motor 17 for rotating the rotatable filter 16, and I.I. 18 for amplifying an image which is transmitted through the rotatable filter 16, and a CCD 19 for capturing an output image from the I.I. 18. The camera acquires fluorescence images of the area to be observed when the area is irradiated with excitation light emitted by the laser beam apparatus 2.
The rotatable filter 16 has a band-pass filter of a type, for example, λ_1=480nm to 520nm and a band-pass filter of a type, for example λ_2=630nm or longer, the rotatable filter 16 being formed into a disc-like shape. When the rotatable filter 16 is rotated, the filters are sequentially inserted into the optical path so that a fluorescence component in each band is allowed to pass.

[0018]
The light-receiving adapter 12 has an image switching device 22 which comprises a movable mirror 20 mounted in the optical path of the image transmitted to the ocular portion 6 of the endoscope 1, and a driver 21 for operating the movable mirror 20. By changing the angle of the movable mirror 2, an image of an object obtained by the endoscope 1 can be projected onto the normal light camera 13 or the fluorescence-light camera 14.

[0019]
A CCU 23 is connected to the normal-light camera 13 to receive the signal (normal image signal), which is the output from the CCD 15. The signal is signal-processed by the CCU 23 so that a video signal for a normal observation image is generated.

[0020]
A fluorescence image processing apparatus 24 is connected to the fluorescence light camera 14 to receive the signal (fluorescence image signal) supplied by the CCD 19. The signal is processed in the fluorescence image processing apparatus 24. Thus, a video signal of a fluorescence observation image is generated.

[0021]
A timing controller 25 for controlling each operation timing is provided so as to transmit a timing signal to each of the drivers to driver 10 for the light-distribution adapter 8, to driver 21 for the light-receiving adapter 12, to the drive motors 17 for the rotatable filter 16 and to the fluorescence image processing apparatus 24.

[0022]
The CCU 23 and the fluorescence image processing apparatus 24 are connected to a video switcher 26 so that the observed normal image signal, which is the output from the CCU 23, and a fluorescence image signal, which is the output from the fluorescence image processing apparatus 24, are selectively switched by the video switcher 26. A foot switch 27 for manually controlling switching of the image and a video switching controller 28 for automatically controlling switching of the image in accordance with the results of calculations performed by the fluorescence image processing apparatus 24 are connected to the video switcher 26. A monitor 29 is connected to the output terminal of the video switcher 26 so that the fluorescence image signal or the normal image signal selected by the video switcher 26 is supplied to the monitor 29. Thus, the fluorescence image or the normal image is displayed on the monitor 29.

[0023]
When observation is performed with the fluorescence observation apparatus according to this embodiment, the timing controller 25 transmits a timing control signal to instruct the light-distribution adapter 8 and the light-receiving adapter 12 to switch the light source and the camera so that fluorescence light observation or normal observation is selected. At this time, the timing controller 25 synchronizes the process to be performed in the fluorescence image processing apparatus 24 with the operations of the movable mirror 9 of the light-distribution adapter 8, the movable mirror 20 of the light-receiving adapter 12, and the rotatable filter 16 of the fluorescence-light camera 14.

[0024]
When normal light observation is performed, the movable mirrors 9 and 20 are moved to the position designated by a continuous line shown in Fig. 1. As a result, normal light is introduced from the lamp light source apparatus 3 into the light guide 4 of the endoscope 1 through the light-distribution adapter 8 so that the area to be observed is irradiated with normal light. An image (a normal observation image obtained from the irradiation of normal light emitted by the lamp 3a is allowed to pass through the image guide 5 and the light-receiving adapter 12 so as to be projected into the normal-light camera 13 so that the image is photographed. The signal from the normal image captured by the CCD 15 is signal-processed by the CCU 23 so that it is transmitted to the video switcher 26 as an observed normal image signal.

[0025]
When the fluorescence light observation is performed, the movable mirrors 9 and 20 are moved to the position designated by the dashed line shown in Fig. 1. As a result, excitation light emitted by the laser beam apparatus 2 is introduced into the light guide 4 of the endoscope 1 through the light-distribution adapter 8 so that the area to be observed is irradiated with excitation light. A fluorescence image (a fluorescence observation image) acquired due to the irradiation of the area with excitation light is allowed to pass through the image guide 5 and the light-receiving adapter 12 and is projected onto the fluorescence-light camera 14. In the fluorescence-light camera 14, the fluorescence components in the wavelength bands λ_1 and $\lambda_2$are filtered by the rotatable filter 16, and the fluorescence image is amplified by the I.I. 18 and the signal from the fluorescence image captured by the CCD 19 is signal-processed by the fluorescence image processing apparatus 24 and it is transmitted to the video switcher 26 as the observed fluorescence image signal.

[0026]
In this embodiment, the timing controller 25 performs switching between the normal light observation and the fluorescence light observation at high speed. As a result, both observed normal image signal and the observed fluorescence image signal are continuously transmitted to the video switcher 26.

[0027]
As a method of displaying the observed normal image and the observed fluorescence image that have been received by the video switcher 26 on the monitor 29, the image is selectively switched in accordance with an instruction issued from the foot switch 27 to display either image. Another method may be employed in which the video switch controller 28 controls the switching of the image to display the fluorescence image in accordance with the results of the calculations performed by the fluorescence image processing apparatus 24 if a diseased area, such as a cancer, is detected. Another method may be employed in which the video switcher 26 combines the observed fluorescence image and the observed normal image in a superimposed display.

[0028]
When the fluorescence light observation is performed, the tissue of an organism is irradiated with violet [actually, blue] light having a wavelength λ_0=442nm formed due to the irradiation with excitation light emitted by the laser beam apparatus (102) so that auto-fluorescence light having a wavelength longer than 442nm is generated. The thus-formed fluorescence images are separated and filtered by the rotatable filter (116) in the fluorescence-light camera (114) into two wavelength regions consisting of λ_1=480 to 520nm and λ_2=630nm or longer so that λ_1 and λ_2 fluorescence images are sequentially acquired.

[0029]
The fluorescence spectrum in a visible region of an area to be observed by the aforementioned (violet) excitation light, as shown in Fig. 2, has the intensity distribution of a wavelength range longer than that of the excitation light λ_0. The fluorescence intensity is intense in a normal area but weak in a diseased area such as a cancer. In particular, the intensity of fluorescence light at the periphery of λ_1 region is intense in a normal area so that the contrast with a diseased area is increased. Thus, a normal area and a diseased area can be distinguished according to the

fluorescence intensity of periphery of λ_1 and a diseased area such as cancer can be diagnosed by such fluorescence image.

[0030]
The fluorescence image processing apparatus 24 calculates, for example, the ratio or the difference between the intensities of fluorescence light having the wavelengths λ_1 and λ_2 in order to generate a fluorescence observation image signal in which the state of the tissue of an organism can be distinguished.

[0031]
Next, the detailed structure of a fluorescence image processing apparatus 24 is illustrated in Fig. 3 and the structure and operation of a fluorescence image processor 24 will be explained. Fig. 3 shows the functional structure of the parts performing the motion compensation process and integration process for fluorescence images in the fluorescence image processing apparatus 24.

[0032]
The fluorescence image processing apparatus 24 comprises:
a control unit 51 for controlling each part of the apparatus;
a multiplexer 52 which switches the fluorescence image signal inputted into the system according to a time sequence;
frame memories 53, 54, 57, 58 for storing fluorescence images;
an image motion compensation device consisting of a motion compensation circuit 55 that detects the motion vector of an image, etc. from the fluorescence images stored in the frame memories 53 and 54 and performs the motion compensation of the fluorescence images;
an integration device consisting of an integration circuit 56 that integrates the motion-compensated fluorescence image stored in the frame memory 57 with the image of the frame memory 58; and
a level detection circuit 59, which is a characteristic quantity detecting device for detecting a predetermined specific quantity of fluorescence images by detecting a signal level of the integrated fluorescence image stored in the frame memory 58 and determining whether it reached the predetermined level or not, etc.

[0033]
In this structure, intensities of fluorescence images are improved process by the fluorescence image processing apparatus 24 by applying the image motion compensation process and the image integration so as to raise the signal level of the fluorescence image above a predetermined value.

[0034]
The control unit 51 sends out control signals to each part of the fluorescence image processing apparatus 24 based on timing control signals from the timing controller 25 to control operations of the components in the apparatus.

[0035]
The fluorescence image signal from the fluorescence-light camera 14 is inputted into the multiplexer 52 in a time sequence and an output destination is selected by the multiplexer 52 and the image signal is stored into the frame memories 53 or 54.
In addition, at the first timing control signal, an image is stored into the frame memory 53. This image becomes the basic image when the motion compensation is performed on a (subsequent) fluorescence image. (Also), at the same time, the same basic image is stored into the frame memory 58 on the output side.

[0036]
A fluorescence image is inputted to the multiplexer 52 on every predetermined timing control signal and each fluorescence image after the aforementioned basic image is stored in the frame memory 54. The motion compensation process of the fluorescence image is performed by comparing the basic image in the frame memory 53 with the image in the frame memory 54 by the motion compensation circuit 55.
In the motion compensation circuit 55, for example, the motion vector of the image in the frame memory 54 is compared to the basic image and is adjusted by the motion compensation circuit so that the coordinates of predetermined area of the images match.

[0037]
The frame memory 57 stores the fluorescence image of the frame memory 54, for which the motion compensation has been performed by the aforementioned motion compensation circuit 55.
Then, the basic image of the frame memory 53 and the fluorescence image (motion compensated image) stored in the frame memory 57 are integrated by the integration circuit 56 and stored in the frame memory 58. In other words, the motion compensated image of the frame memory 57 is integrated with the basic image stored at first by the frame memory 58.

[0038]
Fig. 4 shows the conceptual diagrams of operation of the integration process of the fluorescence image

processing apparatus 24. In the diagrams, a fluorescence image is represented as a one-dimensional signal for simplicity. Among fluorescence images inputted into the multiplexer 52 in Fig. 4 (a), the motion compensation circuit 55 performs the motion compensation process on the images which are inputted after the basic image. As shown in Fig. 4 (b), the motion compensated images are integrated with the basic image by the integration circuit 56.

[0039]
The fluorescence image in the frame memory 58 is outputted after several images are integrated when; for example, the signal level of the integrated fluorescence image reaches the predetermined level. Thus, one integration process is completed and a new integration is started from the next image. In this embodiment, in accordance with the detection result of the level detection circuit 59, when the fluorescence image exceeds the predetermined level V_1, each image integration process is completed. Fig. 4 shows an example when the number of fluorescence images to be integrated is 4. That is, fluorescence images inputted by a time sequence are integrated after the motion compensation is applied. When the predetermined level V_1 is exceeded after the integration of four images, the first integration process is completed and the integrated fluorescence image is outputted from the frame memory 58. After an image integration process is completed, the next fluorescence image being input is stored into the frame memory 53 and 58 as a basic image and then the same process is repeated. In addition, the number of fluorescence images to be integrated can be preset.

[0040]
The level detection circuit 59 detects a signal level of a fluorescence image of the frame memory 58 and outputs a video switching control signal to a video switching controller 28 depending on the detection result. In this embodiment, as shown in Fig. 4 (b), the level detection circuit 59 determines whether the integrated fluorescence image in the frame memory 58 exceeds the predetermined level V_1 or not. If the fluorescence image exceeds the predetermined level V_1, a video switching control signal is outputted. The video switching controller 28 controls the switch of a video signal of the video switcher 26 based on this video switching signal. When the fluorescence image signal exceeds the predetermined level V_1 as shown in Fig. 4 (c), the final fluorescence image signal is outputted. In addition, it is possible to perform the switching operation between a normal observation image and a fluorescence observation image by the aforementioned video switching control signal.

[0041]
Thus, after the motion compensation process is applied to several fluorescence images, by outputting and displaying the result of the integration of these images on the monitor 29 as a fluorescence observation image, the intensity of fluorescence image can be improved and the noise level to a fluorescence signal level can be reduced. Consequently, the quality of fluorescence observation images can be improved and diagnostic value of fluorescence observation can be improved.

[0042]
In addition, in this embodiment, since the result of the integration of several images is displayed as a fluorescence observation image, the time resolution of image display will be reduced by the period of integration. However, in a fluorescence observation apparatus using an endoscope, the distal end of the endoscope with an image light-receiving unit will not usually be moved at high speed. Thus, the possibility of causing a problem such as overlooking diseased areas by reduction of the time resolution is very small.

[0043]
According to this embodiment mentioned above, the following effects can be obtained. The image quality of fluorescence observation images of an area to be observed can be improved by increasing the intensity of a fluorescence image, an errorless and more accurate diagnosis can be performed, and fluorescence diagnostic ability (of the physician) can be improved.

[0044]
Fig. 5 is a block diagram showing the functional structure of a fluorescence image processing apparatus in a fluorescence observation apparatus of the second embodiment of this invention.

[0045]
The second embodiment is a modification of the functional structure of the parts which performs the motion compensation process and integration process of fluorescence images in a fluorescence image processing apparatus. Only the differences in the parts from the first embodiment will be described and descriptions of the same parts will be omitted.

[0046]
In addition to the composition of the first embodiment, a fluorescence image processing

apparatus 24a of the second embodiment is provided with:
a motion vector total-quantity detection circuit 60 as a characteristic quantity detection device for detecting a total quantity of image motion vectors obtained at the time of motion compensation process by the motion compensation circuit 55; and an OR circuit 61 for taking the logical addition of control outputs from an control unit 51 and a level detection circuit 59 based on the detection result of the motion vector total-quantity detection circuit 60.

[0047]
According to this structure, the motion vector total-quantity detection circuit 60 detects motion vectors generated by the motion compensation process by the motion compensation circuit 55 and then calculates and stores a total-quantity of motion vectors. In the case where the total-quantity of the motion vector fulfills predetermined conditions, for example, when an image motion is big and a vector quantity exceeds a specified value, the motion vector total-quantity detection circuit 60 outputs a vector detection signal to the timing control unit 51. Receiving the vector detection signal, the timing control unit 51 outputs a video switching control signal to the OR circuit 61 and, at the same time, the integrated fluorescence image for which the image integration process has been completed is outputted from the frame memory 58.

[0048]
In the OR circuit 61, the logical addition of the control output of the control unit 51 and the level detection circuit 59 is calculated. A video switching control signal from at least one of the timing control unit 51 and the level detection circuit 59 is outputted to the video switching controller 28 via the OR circuit 61.

[0049]
Operations of other components are similar to that of the first embodiment and descriptions of those will be omitted.

[0050]
The total motion vector quantity of fluorescence images obtained by a fluorescence observation apparatus using an endoscope varies depending on the speed of motion of the distal end of endoscope. Therefore, since the number of fluorescence images to be integrated is decided according to the total motion vector quantity, an appropriate fluorescence observation image coping with the moving speed of an endoscope can be obtained.

[0051]
More specifically, when the area under observation is not in focus, in cases such as when the endoscope is being inserted into an area to be examined, or when the position of observation is moved greatly, it may be necessary to move the distal end of the endoscope quickly. In this case, the motion vector total quantity detection circuit can prevent large motion compensation corrections by reducing the number of images being integrated. As the result, overlooking the presence of unexpected lesions can be prevented.

[0052]
According to this embodiment, the quality of a fluorescence observation image can be improved by increasing a fluorescence signal level by integrating fluorescence images. By displaying the fluorescence image after an integration process whose length (i.e. number of integrations) is in accordance with the movement of image, greatly motion compensating a fluorescence image can be prevented. Thus, overlooking lesions in fluorescence images can be prevented and fluorescence diagnostic ability can be improved.

[0053]
Fig. 6 and Fig. 7 relate to a third embodiment of this invention. Fig. 6 is a block diagram showing the functional structure of a fluorescence image processing apparatus in a fluorescence observation apparatus. Fig. 7 is a timing diagram explaining the operation of the fluorescence image processing apparatus.

[0054]
The third embodiment is a structural example of the functional composition of the parts performing the motion compensation process and integration process of fluorescence images in a fluorescence image processing apparatus with circuits for several systems.

[0055]
A fluorescence image processing apparatus 24a of the third embodiment comprises: several sets of the main components consisting of frame memories 53, 54, 57, 58, a motion compensation circuit 55, an integration circuit 56, and a level detection circuit 59 which are the same as that of the first embodiment shown in Fig. 3. It has a control unit 65 for maintaining and controlling each operation in the apparatus and a multiplexer 66 for input and a multiplexer 67 for output are provided to perform each signal transfer on the input and the output side of fluorescence images respectively. That is, the apparatus is provided with several systems (n system, n is an

integer over 2) of signal lines for processing the motion compensation and integration of fluorescence images.

[0056]
Operation of the motion compensation process and integration process is the same as that of the first embodiment. Thus, the explanation will be omitted.

[0057]
In this embodiment, the number of fluorescence images for processing the motion compensation and integration are preset so that this number is considered as m (in this case, m is an integer over 2.). To be simple, the system number n for carrying out the process of motion compensation and integration in the fluorescence image processing apparatus 24b is equalized with m. The intervals of a fluorescence input into the multiplexer 66 is considered as T.

[0058]
At a certain time t_0, a fluorescence image input into the multiplexer 66 is stored into a frame memory (1) 53-1 as the basic image to carry out the motion compensation and integration of the first system. At the next timing; that is at t_0+T, a fluorescence image input in the multiplexer 66 is stored into a frame memory (1) 54-1 as an image to be motion compensated against the basic image in the frame memory (1) 53-1 and it is also stored into a frame memory (2) 53-2 as the basic image to carry out the motion compensation and integration of the second system.

[0059]
Next, at the time t_0 +2T, a fluorescence image input in the multiplexer 66 is stored into frame memories (1) 54-1, (2) 54-2 as images to be compensated against the basic image of the frame memories (1) 53-1 and (2) 53-2 and is also stored into a frame memory (3) 53-3 as the basic image to carry out the motion compensation and integration of the third system.

[0060]
Before the time t_0 +2T image to be motion compensated is stored into the frame memory (1) 54-1, the motion compensation is performed on the time t_0 +1 image stored in the frame memory (1) 54-1 by a motion compensation circuit (1) 55-1. After this motion compensated image is stored into a frame memory (1) 57-1, the image is integrated with the image stored into a frame memory (1) 58-1, which is storing the basic image of the frame memory (1) 53-1, by an integration circuit (1) 56-1.

[0061]
The above-mentioned operation is repeated at a time t_0+3T, t_0 + 4T.... t_0 + kT ...
(k is an integer over 1). When operation reaches k = m, the fluorescence image accumulated in the frame memory (1) 58-1 is outputted via the multiplexer 67.

[0062]
When the fluorescence image is outputted from the frame memory (1) 58-1, the basic images of the time t_0 of the frame memories (1) 53-1 and (1) 58-1 are overwritten by the basic images of fluorescence image at the time t_0 + mT.
This is equivalent to completion of the first cycle of the motion compensation process and the integration process by the first system, and the fluorescence image which has been processed is outputted, and a basic image for the second cycle is taken in.

[0063]
As for the second system, the same operation is performed as for the first system at a time which is delayed from that of the first system by the time T. Therefore, at the time t_0 + (m+1)T, the motion compensation process and integration process of the second system, are completed, and the fluorescence image accumulated in a frame memory (2) 58-2 is outputted via the multiplexer 67. The basic images of frame memories (2) 53-2 and (2) 58-2 of the time t_0 +T are overwritten by the basic images of time t_0 +(m+1)T.

[0064]
By further repeating the above operation, it is possible to output fluorescence images at time intervals of T, when the input of fluorescence images of time intervals is T, by using n system signal lines and applying the motion compensation process and integration process to m=n fluorescence images. That is, fluorescence images can be outputted at intervals shorter than mT, which is the output intervals of fluorescence images in which the integration process is performed by a single system (of signal lines) that applies the motion compensation process and integration process to fluorescence images.
Thus, even when the process to integrate several fluorescence images is performed, fluorescence images can be outputted at the same intervals as the intervals used for fluorescence image input so that the time resolution of image display can be maintained equal to the one before processing.

[0065]
The level detection circuit (n) 59-n in each system detects a signal level of fluorescence image stored in

a frame memory (n) 58-n similar to the first embodiment, outputs a video switching control signal to a video switching controller 28 when a fluorescence image exceeds a specified level in accordance with the detection result. The switch of video signal in the video switcher 26 is controlled by the video switching controller 28 according to this video switching control signal so that the fluorescence image from the multiplexer 67 can be outputted as a final signal of fluorescence observation image, and the display can be switched between a normal observation image and a fluorescence observation image.

[0066]
Now, when the motion compensation process and integration process are carried out, if the number of image integrations m is equalized with the system number n of a signal line, the cost of hardware may become a problem. In this case, a method to maintain appropriate time resolution can be considered by setting m and n to fulfill a relationship of m=kn (k=1, 2, 3...) considering m>n. For example, Fig 7 illustrates the conceptual diagram of operation of the fluorescence image processing apparatus 24b regarding the integration process which is set to m=4, n=2. The fluorescence image is illustrated as a one-dimensional signal similar to Fig. 4 for simplicity.

[0067]
Among fluorescence images input in the multiplexer 66 of Fig. 7 (a), the motion compensation process is applied to the images to be motion compensated (shown as B in the diagram) by a motion compensation circuit (1) 55-1 when compared to basic images (shown as A in the diagram). The motion compensated images are integrated with the basic image in a frame memory (1) 58-1 by an integration circuit (1) 56-1 as in Fig. 7 (b). That is, every four fluorescence images inputted at the time intervals T are motion compensated and integrated and outputted from the frame memory (1) 58-1 as shown in Fig. 7 (c).

[0068]
As for the second system, the motion compensation process is applied to images in a motion compensation circuit (2) 55-2 at the timing delayed 2T from that of the first system. As shown in Fig. 7 (d), after motion compensated images are integrated with the basic image in a frame memory (2) 58-2 by an integration circuit (2) 56-2, the fluorescence image accumulated is outputted from the frame memory (2) 58-2 as shown in Fig. 7 (e).

[0069]
Fluorescence images outputted from the frame memories (1) 58-1 and (2) 58-2 are respectively outputted via the multiplexer 67. Thus, although the integration process intervals of images is set to 4T as shown in Fig. 7, the fluorescence images outputted from the multiplexer 67 as a composite fluorescence image output of the signal line of subsequent systems, can be outputted at the time intervals of 2T as shown in Fig. 7 (f).

[0070]
As described above, by providing a structure to perform the motion compensation process and integration process in several systems and by performing the motion compensation and integration of fluorescence images with a (staggered) delay in the timing of several systems, a significant decrease in the time resolution of the image display and in (the continuity of) motion of the fluorescence images can be prevented. By increasing the intensity of fluorescence images and thereby, improving the quality of fluorescence images of observed areas, the fluorescence diagnostic ability (of the physician) can be improved.

[0071]
Next, a first example of a fluorescence observation apparatus having variable intensities and irradiation intervals of excitation light is shown in Fig. 8 and Fig. 9.

[0072]
Since the fluorescence emitted from organism's tissue is very weak, an apparatus for performing fluorescence observation of an observed area by irradiating the area with excitation light requires a high sensitivity camera to capture fluorescence images of the observed area. There is the possibility of not being able to capture excellent fluorescence images because the signal level of fluorescence image is low. This problem can be solved and the quality of the fluorescence image can be improved by performing an integration process like in the embodiment described above. It is conceivable, however, that the intensity of a fluorescence image can also be improved by increasing the intensity of excitation light.
There is the possibility of damaging an organism's tissue when the intensity of excitation light is increased. Thus, in this example, the apparatus is structured so that a change in the intervals of time between which excitation light irradiates (the tissue) accompanies a change in the intensity of the excitation light.

[0073]
As shown in Fig. 8, a fluorescence observation apparatus, which is provided with an excitation light source 71 for generating excitation light; and an output control unit 72 that operates as a control device for excitation light output and controls the intensity of excitation light emitted from the excitation light source 71, irradiates an observed area with excitation light of an organism's tissue 73.
It contains:
a high sensitivity camera 74 which contains an image intensifier, etc. for capturing fluorescence images;
a fluorescence image processing unit 75 for processing the signal of a fluorescence image captured by the high sensitivity camera 74; and
a display device 76 such as a monitor for displaying the fluorescence image generated by the fluorescence image processing unit 75;
The apparatus captures the fluorescence from the organism's tissue 73 by recording it with the high sensitivity camera 74 and displays the acquired fluorescence image by processing the signal in the fluorescence image processing unit and displaying it on the display device 76.
The apparatus is further provided with a timing controller 77 as a synchronization device for controlling the operation timing of each part.
The apparatus is structured so that the timing of the irradiation of excitation light and the signal processing of fluorescence images in the output control unit 72, the high sensitivity camera 74, and the fluorescence image processing unit 75 is synchronized by timing control signals sent from the timing controller 77.

[0074]
In this structure, when the intensity of fluorescence obtained from the organism's tissue 73 is low, the intensity of excitation light from the excitation light source 71 is increased by the output control unit 72 so as to also increase the intensity of fluorescence from the organism's tissue 73. At this time, as shown in Fig. 9, the interval T between which excitation light irradiating (the tissue) is increased from T1 to T2 (T1<T2) in accordance with the increase of the intensity of excitation light. By doing this, damage to tissue can be prevented.

[0075]
By increasing the intensity of excitation light used to irradiate an organism's tissue as well as increasing the intervals between irradiation by excitation light, the intensity of the fluorescence and, hence, the signal level of fluorescence images can be increased without damaging the organism's tissue. Thus, accuracy of diagnosis can be improved by improving the image quality of a fluorescence observation image.

[0076]
Next, a second example of a fluorescence observation apparatus having variable intensities and irradiation intervals of excitation light is shown in Fig. 10 and Fig. 11.

[0077]
This example is a modification of the first example shown in Fig. 8 and is an example of a fluorescence observation apparatus which can be used for both fluorescence observation and normal light observation.

[0078]
In addition to the structure of Fig. 8, the fluorescence observation apparatus of this example is provided with:
an illumination light source 81 for generating illumination light such as white light for normal observation;
a normal observation camera 82 for capturing an image of the object illuminated by the light for normal observation; and
a normal image processing unit 83 for processing the signal from images captured by the normal observation camera 82.
The apparatus is structured so as to use the illumination light source 81 to irradiate an observed area of the organism's tissue 73 and to acquire a normal observation image of the organism's tissue 73.
A light- receiving switch device 84 (of a similar composition to the light-receiving adapter 12 in Fig.1, for example.) switches the destination to which the images are output depending on whether the excitation light or (normal) illumination light is provided. The fluorescence images of an observed area are projected onto the high sensitivity camera 74 and normal image are projected onto a normal observation camera 82 by the light-receiving switch device 84. The outputs of the fluorescence image processing unit 75 and the normal image processing unit 83 are connected to the display switching device 85 so that either the fluorescence observation image or the normal observation image are selected by the display switching device 85 and sent to the display device 76.

[0079]
In addition, the timing controller 77 for controlling the timing of the operation of each part sends a timing control signal to the output control unit 72, the illumination light source 81, and the light-receiving

switch device 84 to synchronize the processing of a fluorescence image with the irradiation of excitation light and the processing of a normal image with the illumination by light for normal observation.

[0080]
Like the first example, when the intensity of the fluorescence obtained from the organism's tissue 73 is low, the fluorescence intensity from the organism's tissue is increased by increasing the intensity of excitation light from the excitation light source 71 using the output control unit 72. The time interval between irradiation with excitation light is also increased accordingly.
When alternately observing a fluorescence image and a normal image [and the fluorescence intensity from the organism's tissue is increased by increasing the intensity of the excitation light from the excitation light source 71], then the interval of time between acquiring fluorescence images is increased by a factor depending on the length of time (of a cycle) during which excitation light and illumination light are used as shown in Fig. 11. For example, fluorescence observation images are acquired every 1/30 sec when the intensity of excitation light is not increased. When the intensity of excitation light is increased, fluorescence images are acquired at intervals of integral multiples of 1/30 sec (e.g. acquired at intervals of 1/15 sec as shown Fig. 11). The number of integral multiples of 1/30 sec that the interval between fluorescence images is increased by will depend on the intensity of excitation light.

[0081]
Thus, by increasing the intensity of the excitation light used to irradiate an organism's tissue as well as increasing the interval of time between irradiation by excitation light and the time interval between obtaining fluorescence images, the signal level of fluorescence images can be increased by increasing the fluorescence intensity without damaging an organism's tissue. Excellent normal images by the illumination light and fluorescence images by the excitation light can be obtained in real time. (Note: fluorescence images will not be real time)

[0082]
Next, Fig. 12 illustrates an example of the image display of a fluorescence image and normal image on a display monitor.

[0083]
A fluorescence observation apparatus for normal observation of an object image irradiated by white light and for observation of fluorescence images from an organism's tissue, images are displayed on a monitor by alternately switching between a fluorescence image and a normal image or by combining the two images, etc.

[0084]
In this example, as shown in Fig. 12, when a diseased area exists in the fluorescence image (a), a boundary (b) of a normal area and a diseased area is overlaid on the normal image as a boundary line 91, so that the location of diseased area is indicated in the normal image.

[0085]
Thus, the location of a diseased area can be displayed without losing the depth perception provided by the normal observation image produced by illumination light and the visibility during diagnosis can be improved.

[0086]
[Additional Remark]
(1) A fluorescence observation apparatus with a light source device for fluorescence observation that generates excitation light for exciting fluorescence from an observed area and an image detecting device for fluorescence observation which acquires a fluorescence observation image of the observed area, (the fluorescence of the observed area being) the result of the excitation light from the aforementioned light source device for fluorescence observation, is provided with:
an image motion compensation device for performing the image motion compensation for several fluorescence images obtained during a time sequence from the aforementioned image detecting device for fluorescence observation; and an integration device for integrating the several fluorescence images which have been motion-compensated by the aforementioned image motion compensation device. The image integrated by the aforementioned integrating device is displayed as a fluorescence observation image.

[0087]
(2) A fluorescence observation apparatus which is provided with:
a light source device for normal observation for generating illumination light for normal observation;
an image detecting device for normal observation for detecting a normal observation image of an observed are by the illumination light from the aforementioned normal observation light source device;
a light source device for fluorescence observation which generates excitation light to excite fluorescence of an observed area;

an image detecting device for fluorescence observation for detecting a fluorescence observation image of an observed area based on the excitation from the excitation light from the aforementioned fluorescence observation light source device.
A fluorescence observation apparatus which displays a fluorescence observation image and a normal observation image simultaneously or switched in a time divided manner, and contains:
an image motion compensation device for performing image motion compensation in several fluorescence images obtained by a time sequence from the aforementioned fluorescence observation image detecting device;
an integration device for integrating several fluorescence images to apply the motion compensation by the aforementioned image motion compensation device. A fluorescence observation apparatus which displays the integrated image by the aforementioned integration device as a fluorescence observation image.

[0088]
(3) In a fluorescence observation apparatus mentioned in the additional remark (1), the number of images to be motion compensated and integrated in the aforementioned image motion compensation device and integration device is variable.

[0089]
In this structure, when displaying the result of integration of these images as a fluorescence observation image after the motion compensation process is applied to several fluorescence images, by making the number of images to be motion compensated and integrated variable, a fluorescence observation image suitable to an observed area can be displayed and an improvement in the image quality can be realized.

[0090]
(4) In a fluorescence observation apparatus mentioned in the additional remark (1), a characteristic quantity detection device is provided to detect a predetermined characteristic quantity of fluorescence images processed by the aforementioned image motion compensation device and integration device, and the number of images to be motion compensated and integrated is decided based on the predetermined characteristic quantity.

[0091]
In this structure, the number of images to be motion compensated and integrated by the image motion compensation device and the integration device is decided based on the predetermined characteristic quantity obtained by fluorescence images of an observed area. Thus, an appropriate fluorescence observation image can be displayed depending on the observed area and an improvement in the quality of the image can be realized.

[0092]
(5) In a fluorescence observation apparatus mentioned in the additional remark (4), the aforementioned characteristic quantity detection device is consists of a level detection device which detects a signal level of fluorescence images of the output of the aforementioned integration device, and the number of images to be motion compensated and integrated by the aforementioned image motion compensation device and the integration device is determined based on the signal level of the integrated fluorescence image detected by this level detection device.

[0093]
In this structure, based on the signal level of the integrated fluorescence image, the aforementioned motion compensation and integration of fluorescence images by the aforementioned image motion compensation device and the integration device are completed so that an excellent fluorescence observation image with a predetermined level complying with an observed area can be obtained and diagnostic ability can be improved.

[0094]
(6) In a fluorescence observation apparatus mentioned in the additional remark (4), the aforementioned characteristic quantity detection device is formed by a motion vector detection device for detecting the sum of motion vectors of fluorescence images obtained by the aforementioned image motion compensation device and the number of images to be motion compensated and integrated by the aforementioned image motion compensation device and the integration device is determined based on the sum of the motion vectors of florescence image detected by this motion vector detection device.

[0095]
In this structure, by determining the number of images to be motion compensated and integrated by the image motion compensation device and integration device based on the motion vector sum of fluorescence images, an appropriate fluorescence observation image can be displayed in accordance with the movement of the endoscope containing a fluorescence observation image detecting device, and

an improvement in the quality of image can be realized.

[0096]
(7) A fluorescence observation apparatus mentioned in the additional remark (6) in which the motion compensation and integration of fluorescence images are completed when the motion vector sum of fluorescence images detected by the aforementioned motion vector detection device exceeds the predetermined value.

[0097]
In this structure, by determining the number of images to be motion compensated and integrated by the image motion compensation device and the integration device based on the motion vector sum of fluorescence images, an appropriate fluorescence observation image can be displayed in accordance with the speed of motion of the distal end of endoscope containing a fluorescence observation image detecting device, and overlooking of unexpected diseased areas when the fluorescence observation image detecting device is moved can be prevented.

[0098]
(8) In a fluorescence observation apparatus mentioned in the additional remark (1), al combination of the image motion compensation devices and the integration devices are provided to perform the aforementioned motion compensation and integration. Only m frames (where m is an integer greater than or equal to two) of fluorescence images from the aforementioned fluorescence observation image detecting device, which are taking in by the time interval T, are motion compensated and integrated, and the display of fluorescence observation image is renewed in intervals shorter than mT.

[0099]
In this structure, the motion compensation and the integration are performed by a combination of the image motion compensation devices and the integration devices in order to update the display of fluorescence observation image at the time interval shorter than the time of integration of several fluorescence images. Thus, a reduction in the time resolution of fluorescence image display can be prevented and the quality of fluorescence observation image can be improved.

[0100]
(9) In a fluorescence observation apparatus mentioned in the additional remark (8), the relationship between the combination number n (where n is an integer greater than or equal to two) of the aforementioned image motion compensation devices and integration devices, and the number of images m to which the aforementioned motion compensation and integration is applied is m=kn (where k is a an integer than or equal to one).

[0101]
According to this structure, the quality of fluorescence observation image can be improved while maintaining the appropriate time resolution of fluorescence image display. Especially in the case of k=1, the deterioration of time resolution is eliminated.

[0102]
(10) In the fluorescence observation apparatus mentioned in the additional remark (1) which is provided with: an output control device of excitation light for changing the intensity of excitation light which irradiates the aforementioned observed area and the time intervals of the irradiation of the excitation light; and a synchronization device for acquiring a fluorescence observation image of the observed area in synchronization with the irradiation intervals of the aforementioned excitation light.

[0103]
In this structure, since the intensity of the excitation light to irradiate an observed area and the time intervals of the irradiation of the excitation light using the excitation light output control device are variable and fluorescence observation images are detected in synchronization with the variable irradiation time of excitation light, strong intensities of fluorescence can be acquired without damaging the living tissue. Thus, it is possible to increase a signal level of a fluorescence and to improve the quality of fluorescence observation images.

[0104]
[Effect of the Invention]
According to this invention as described above, the quality of fluorescence observation images of an observed area can be improved by increasing the intensity of fluorescence images so that higher diagnostic ability can be achieved.

[Brief Explanation of the Drawings]
[Fig. 1]
Fig. 1 through Fig. 3 relate to the first embodiment of this invention. Fig. 1 is a schematic diagram showing the overall structure of a fluorescence observation apparatus.

[Fig. 2]
Fig. 2 is a characteristic diagram showing the spectrum of fluorescence on an area to be observed of organism's tissue.

[Fig. 3]
Fig. 3 is a block diagram showing the functional structure of a fluorescence image processing apparatus.

[Fig. 4]
Fig. 4 is a timing diagram explaining the operation of the fluorescence image processing apparatus.

[Fig. 5]
Fig. 5 is a block diagram showing the functional structure of a fluorescence image processing apparatus in a fluorescence observation apparatus of the second embodiment of this invention.

[Fig. 6]
Fig. 6 and Fig. 7 relate to a third embodiment of this invention. Fig. 6 is a block diagram showing the functional structure of a fluorescence image processing apparatus in a fluorescence observation apparatus.

[Fig. 7]
Fig. 7 is a timing diagram explaining the operation of the fluorescence image processing apparatus.

[Fig. 8]
Fig. 8 and Fig. 9 relate to a first example of the fluorescence observation apparatus in which the intensity of excitation light and the irradiation intervals are variable. Fig. 8 is a block diagram showing the structure of a fluorescence observation apparatus.

[Fig. 9]
Fig. 9 is an explanation drawing of operation showing the intensity of excitation light and the irradiation intervals of the fluorescence observation apparatus of Fig. 8.

[Fig. 10]
Fig. 10 and Fig. 11 relate to a second example of the fluorescence observation apparatus in which the intensity of excitation light and the irradiation intervals are variable. Fig. 10 is a block diagram showing a structure of a fluorescence observation apparatus.

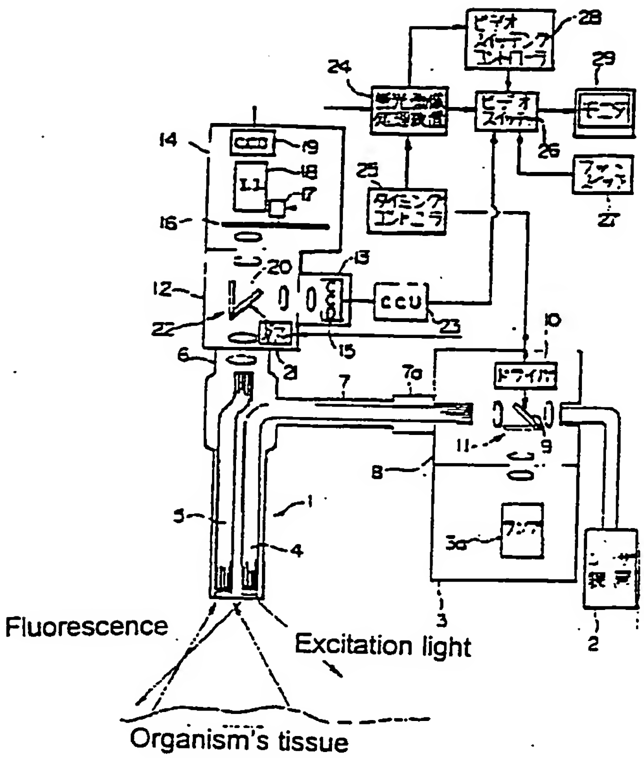
[Fig. 11]
Fig. 11 is an explanation drawing of operation showing the intensity of excitation light and the timings of illumination and take-in images.

[Fig. 12]
Fig. 12 is an explanation drawing showing the example of the effect of the image display of fluorescence images and normal images on the screen of the display monitor.

[Explanations of Symbols]
1...endoscope
2...laser apparatus
3...lamp light source device
8... light-distribution adapter
12...light receiving adapter
13...normal observation camera
14...fluorescence observation camera
23...CCU
24...fluorescence image processor
25...timing controller
26...video switcher
28...video switching controller
29...monitor
51...control unit
52 ...multiplexer
53, 54, 57, 58...frame memory
55...motion compensation circuit
56...integration circuit
59...level detection circuit

【図１】

[FIGURE 1]

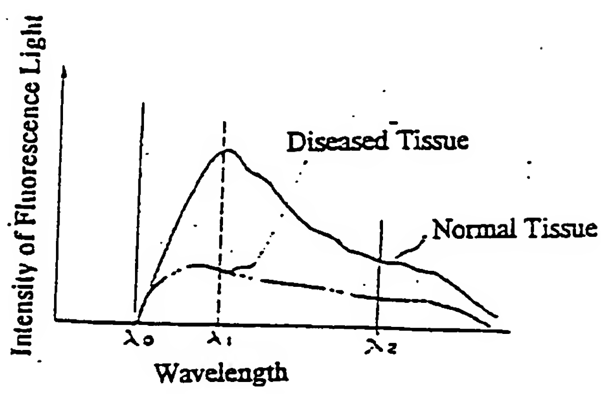


[translation of Japanese text in Figure 1]
also refer to EXPLANATION OF DRAWINGS

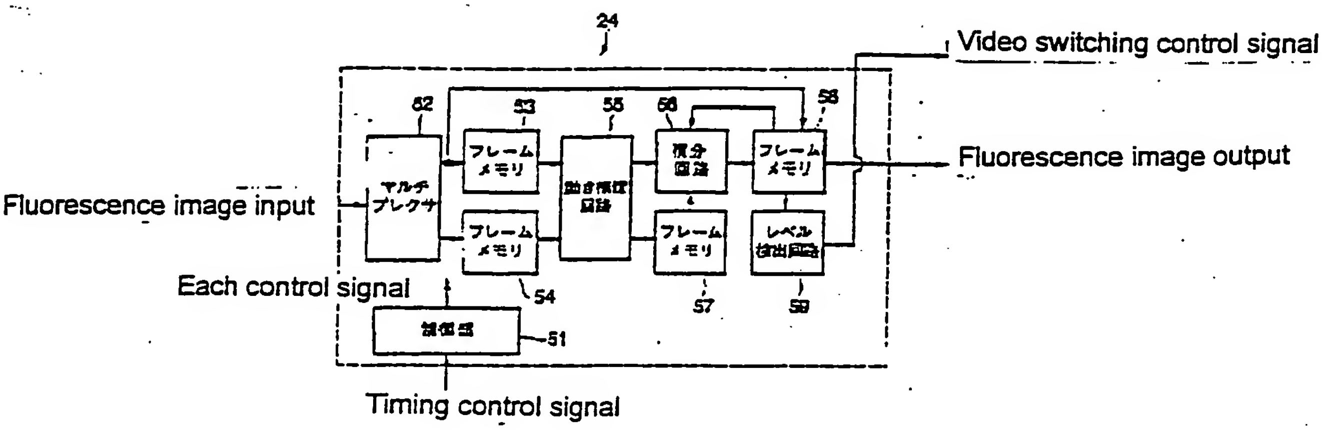
10	driver
21	driver
27	foot switch
30	lamp

【図２】

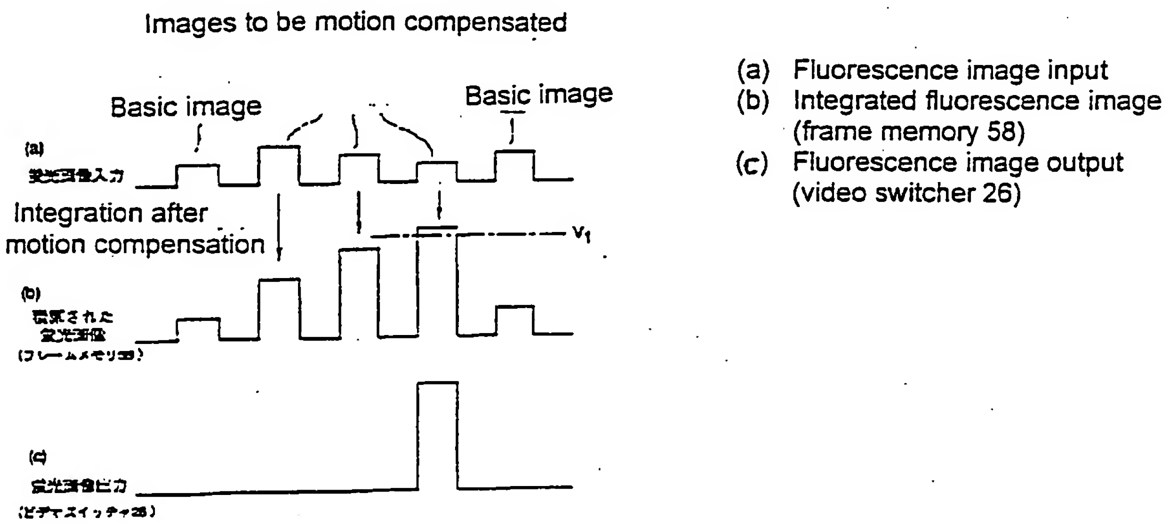
[FIGURE 2]



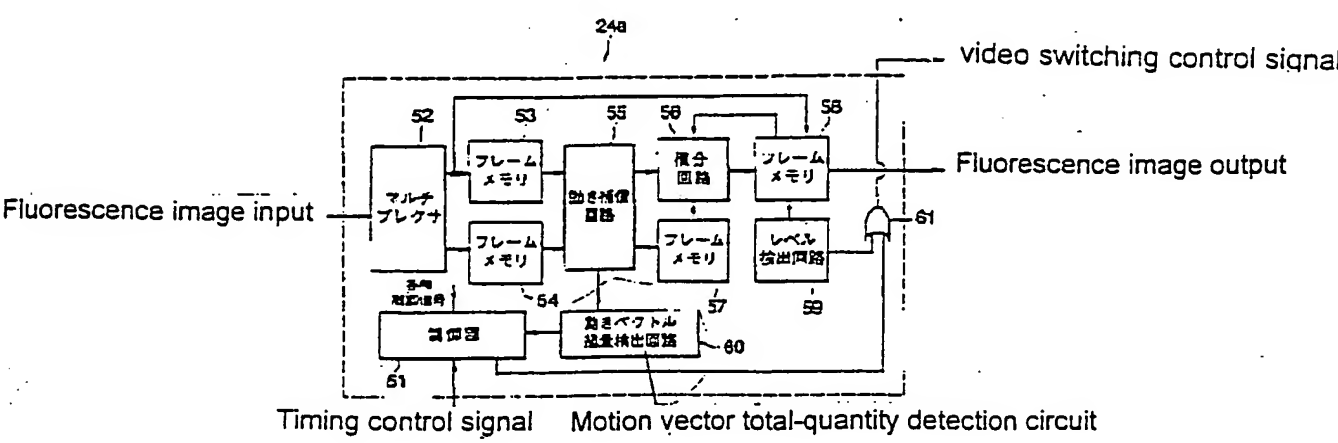
【図3】 [FIGURE 3]



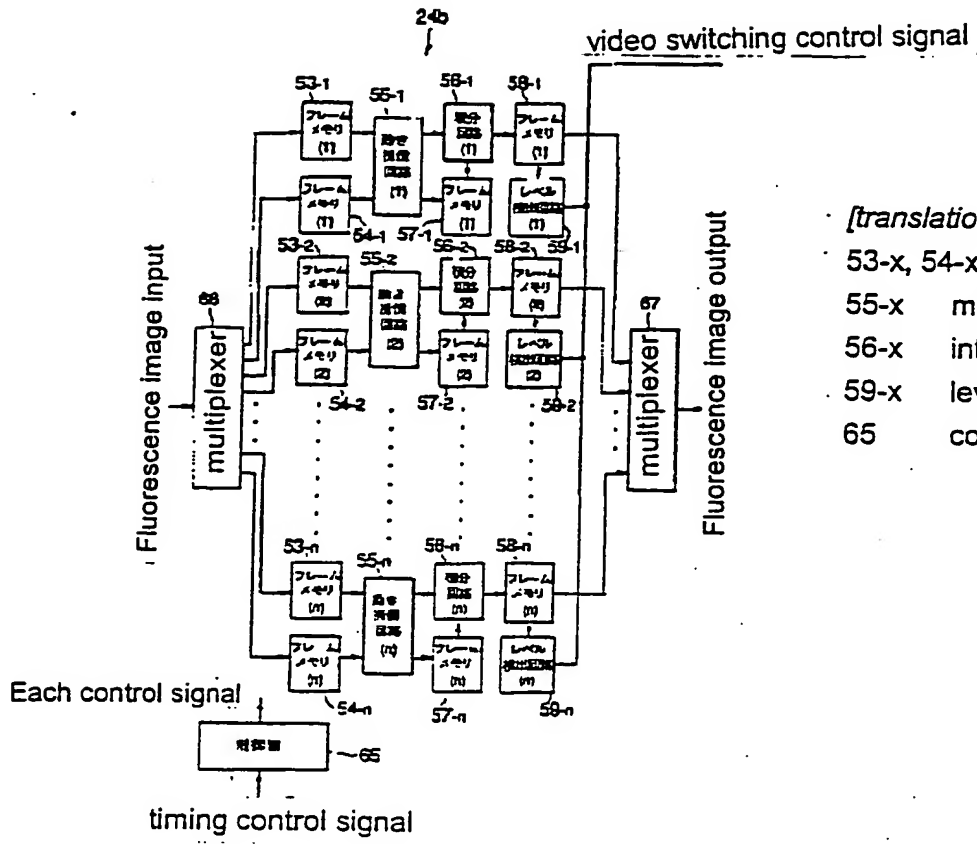
【図4】 [FIGURE 4]



【図5】 [FIGURE 5]



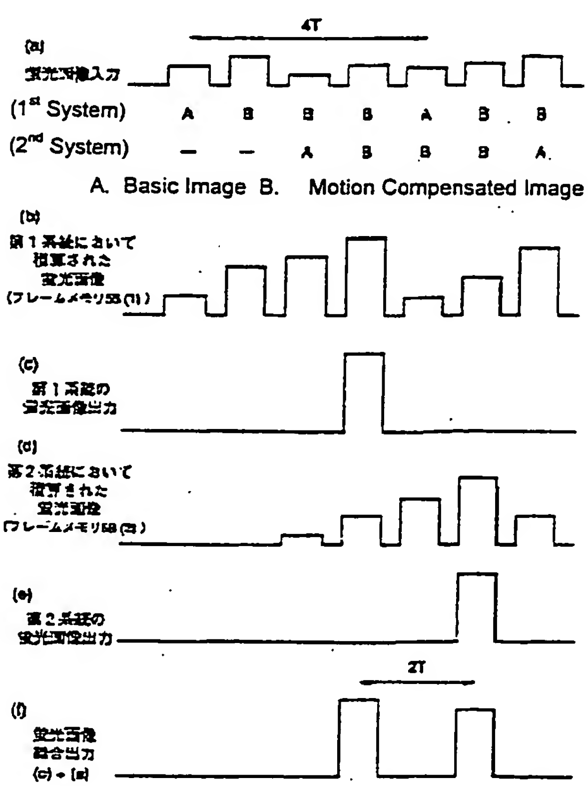
【図 6】 [FIGURE 6]



[translation of Japanese text in Figure 6]

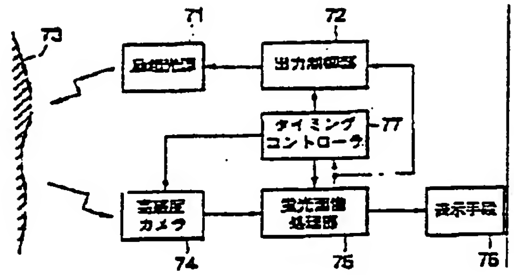
53-x, 54-x, 57-x, 58-x	frame memory (x)
55-x	motion compensating circuit-x
56-x	integration circuit-x
59-x	level detection circuit-x
65	controller

【図 7】 [FIGURE 7]



(a)	Fluorescence image input
(b)	Fluorescence image integrated in 1st system (Frame memory (58) 1)
(c)	Fluorescence image output from 1st system
(d)	Fluorescence image integrated in 2nd system (Frame memory (58) 2)
(e)	Fluorescence image output from 2ns system
(f)	Fluorescence image combined output (c) + (e)

【図8】 [FIGURE 8]



[translation of Japanese text in Figure 8]

71 excitation light

72 output controller

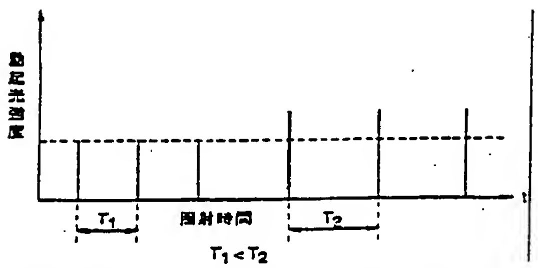
74 high sensitivity camera

75 fluorescent image processor

76 display means

77 timing controller

【図9】 [FIGURE 9]

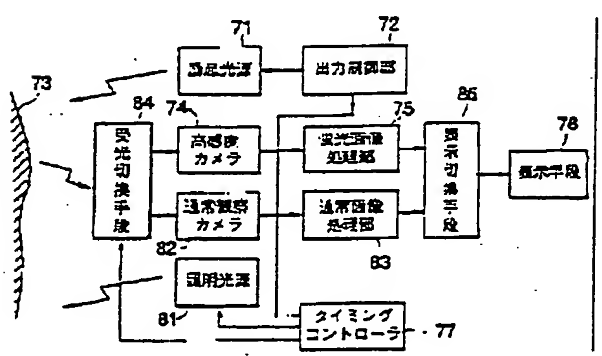


[translation of Japanese text in Figure 9]

vertical axis: excitation light intensity

horizontal axis: duration of irradiation

【図10】 [FIGURE 10]



[translation of Japanese text in Figure 10]

71 excitation light source

72 output controller

74 highly sensitive camera

75 fluorescent image processor

76 display means

77 timing controller

81 irradiation light source

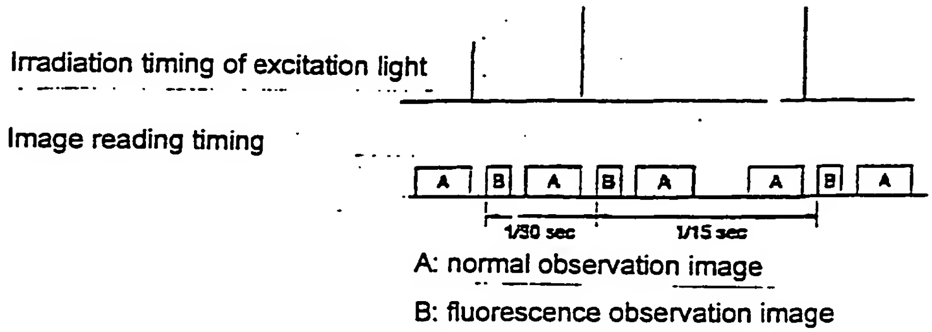
82 normal observation camera

83 normal image processor

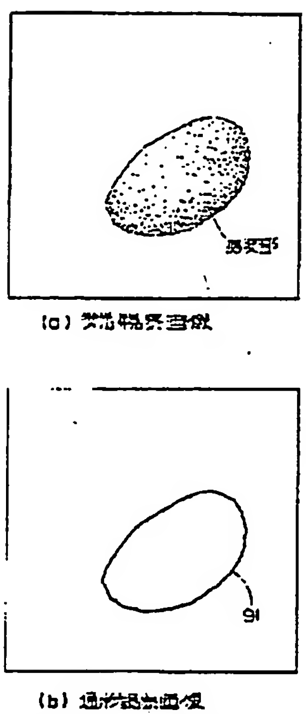
84 light receiving switching means

85 display switching means

【図１１】 [FIGURE 11]



【図１２】 [FIGURE 12]



[translation of Japanese text in Figure 12]

(a) fluorescent observation image

diseased part

(b) normal observation image

DERWENT

MACHINE-ASSISTED TRANSLATION (MAT):

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(57)【要約】	**(57)[SUMMARY]**

【目的】
蛍光画像の強度を向上させて観察対象部位の蛍光観察画像の画質を向上させ、診断能力を高める。

[OBJECT]
Strength of a fluorescent image is raised and the image quality of the fluorescent observation image of the site for observation is improved.

Thereby the diagnostic capability is raised.

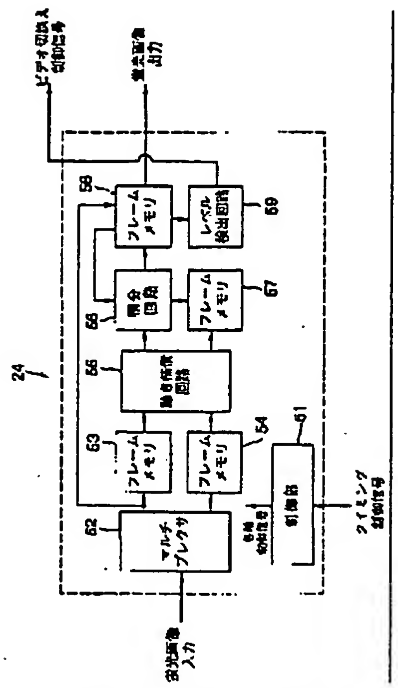
【構成】
蛍光観察装置は、観察対象部位へ励起光を照射しこの励起光による蛍光を撮像して得た観察対象部位の蛍光画像を信号処理する蛍光画像処理装置２４を備えており、この蛍光画像処理装置２４において、時系列的に入力される蛍光画像を記憶するフレームメモリ５３，５４、フレームメモリ５３及び５４に記憶された蛍光画像より画像の動きベクトル等を検出して蛍光画像の動き補償を行う動き補償回路５５、動き補償処理されフレームメモリ５７に記憶された蛍光画像をフレームメモリ５８の画像に積算する積分回路５６を有し、所定数積算した画像を出力してモニタに蛍光観察画像として表示するようになっている。

[SUMMARY OF THE INVENTION]
A fluorescent observation apparatus irradiates excitation light to the site for observation, and is equipped with the fluorescent image processing device 24 which carries out the signal processing of the fluorescent image of the site for observation which recorded and obtained the fluorescence by this excitation light.

In this fluorescent image processing device 24, the motion vector of an image etc. is detected from the fluorescent image stored by the frame memories 53 and 54 which store the fluorescent image input in a time sequence, and the frame memories 53 and 54.

It has the motion compensating circuit 55 which performs motion compensation of a fluorescent image, and the integration circuit 56 which integrates the fluorescent image which the motion compensation process was carried out and was stored by the frame memory 57 for the image of a frame memory 58.

A predetermined-number of images are integrated and output, and it displays as fluorescent observation image to a monitor.



[translation of text in Selection Diagram]
refer to Figure 3

【特許請求の範囲】

[CLAIMS]

【請求項１】
観察対象部位の蛍光を得るための励起光を発生する蛍光観察用光源手段と、前記蛍光観察用光源手段からの励起光による励起に基づく観察対象部位の蛍光観察像を撮像する蛍光観察用撮像手段とを備え、蛍光観察画像を表示する蛍光観察装置であって、
前記蛍光観察用撮像手段より時系列的に得られる複数の蛍光画像間における画像の動き補償を行う画像動き補償手段と、

[CLAIM 1]

It has fluorescent light-source means for observation to generate the excitation light for obtaining the fluorescence of the site for observation, and fluorescent image-pick-up means for observation to image-pick up the fluorescent observation image of the site for observation based on the excitation by the excitation light from above-mentioned fluorescent light-source means for observation.

It is the fluorescent observation apparatus which displays fluorescent observation image.
Comprising, image motion compensation means to perform motion compensation among

前記画像動き補償手段によって動き補償が施された複数の蛍光画像を積算する積分手段とを有し、
前記積分手段によって積算された画像を蛍光観察画像として表示することを特徴とする蛍光観察装置。

the fluorescent images in a time sequence from above-mentioned fluorescent image-pick-up means for observation, it has the integrator which integrates some of the fluorescent image by the above-mentioned image motion compensation means, and motion compensation was performed.

The image by which integrating was carried out as for the above-mentioned integrator is displayed as fluorescent observation image.

The fluorescent observation apparatus characterized by the above-mentioned.

【発明の詳細な説明】

[DETAILED DESCRIPTION OF INVENTION]

【０００１】

[0001]

【産業上の利用分野】
本発明は、励起光を生体組織の観察対象部位へ照射して前記励起光によって観察対象部位から発する蛍光像を観察する蛍光観察装置に関する。

[INDUSTRIAL APPLICATION]
This invention relates to the fluorescent observation apparatus which observes the fluorescent image whereby excitation light is irradiated to the site for observation of an organism tissue, and it is emitted from the site for observation by the above-mentioned excitation light.

【０００２】

[0002]

【従来の技術】
近年、生体組織の観察対象部位へ励起光を照射し、この励起光によって生体組織から直接発生する自家蛍光や生体へ注入して

[PRIOR ART]
In recent years, excitation light is irradiated to the site for observation of an organism tissue.
The self-fluorescence directly generated from an organism tissue by this excitation light, and

おいた薬物の蛍光を２次元画像として検出し、その蛍光像から生体組織の変性や癌等の疾患状態（例えば、疾患の種類や浸潤範囲）を診断する技術が用いられつつあり、この蛍光観察を行うための蛍光観察装置が開発されている。

by using the fluorescence of the medicine injected into the organism, it is detected as a two-dimensional image.

The technique whereby illness states (for example, the kind and permeation extent of the illness), such as the modification of an organism tissue and cancer, are diagnosed from the fluorescent image is used, and the fluorescent observation apparatus for performing this fluorescent observation is developed.

【０００３】

自家蛍光の観察においては、生体組織に励起光を照射すると、その励起光より長い波長の蛍光が発生する。生体における蛍光物質としては、例えばＮＡＤＨ（ニコチンアミドアデニンヌクレオチド），ＦＭＮ（フラビンモノヌクレオチド），ピリジンヌクレオチド等がある。最近では、このような蛍光を発生する生体内因物質と疾患との相互関係が明確になりつつあり、これらの蛍光により癌等の診断が可能である。

[0003]

In an observation of a self-fluorescence, if excitation light is irradiated to an organism tissue, the fluorescence of a wavelength longer than the excitation light will occur.

It uses as the fluorescent material in the organism, for example, there are NADH (nicotinamide adenine nucleotide), FMN (flavin mononucleotide), pyridine nucleotide, etc.

Recently, the interactive relationship of ?factor-substance? in the living body and the illness which generate such a fluorescence is becoming clear, and the diagnosis of cancer etc. is possible by these fluorescence.

【０００４】

また、薬物の蛍光の観察において生体内へ注入する蛍光物質としては、ＨｐＤ（ヘマトポルフィリン），Photofrin，ＡＬＡ（δ-amino levulinic acid ）等が用いられる。これらの蛍光剤は癌などへの集積性があり、これを生

[0004]

Moreover, HpD (hematoporphyrin), Photofrin, ALA((delta)-amino levulinic acid), etc. are used as a fluorescent material injected into in the living body in fluorescent observation of a medicine.

These fluorescence agents have accumulation property, such as towards cancer.

体内に注入して蛍光を観察することで疾患部位を診断できる。また、モノクローナル抗体に蛍光物質を付加させ、抗原抗体反応により病変部に蛍光物質を集積させる方法もある。

An illness site can be diagnosed by injecting this in the living body and observing a fluorescence.

Moreover, a fluorescent material is added to a monoclonal antibody, and there is also a method of making a disease part accumulate the fluorescent material by an antigen antibody reaction.

【０００５】

励起光としては例えばエキシマレーザ，クリプトンレーザ，Ｈｅ－Ｃｄレーザ，色素レーザなどのレーザ光が用いられ、励起光を生体組織へ照射することによって観察対象部位の蛍光像を得る。この励起光による生体組織における微弱な蛍光を検出して２次元の蛍光画像を生成し、観察、診断を行う。生体組織における蛍光は、正常部と病変部とで蛍光強度及びそのスペクトルが変化する。そこで、蛍光の強度，スペクトルの一部を蛍光画像として検出し、これを分析することで正常部と癌等の病変部とを判別でき、疾患部位を同定することができる。

[0005]

It uses as excitation light, for example, laser lights, such as an excimer laser, a krypton laser, a He-Cd laser, and a dye laser, are used.

The fluorescent image of the site for observation is obtained by irradiating excitation light to an organism tissue.

The slight fluorescence in the organism tissue by this excitation light is detected, and a two-dimensional fluorescent image is formed, and observation and a diagnosis are performed.

As for the fluorescence in an organism tissue, the fluorescence intensity and its spectrum vary in a normal part and a disease part.

Then, it is detected, using a part of fluorescent strength and spectrum as a fluorescent image.

A normal part and disease parts, such as from cancer, can be distinguished by analyzing this, and an illness site can be identified.

【０００６】

本出願人は、特願平５－３０４４２９号において、内視鏡等を用いた装置により波長λ０（例えば４４２ nm）の励起光を照射して生体組織からの蛍光像を検出し、正常部と病変部とで蛍

[0006]

In the unexamined Japanese patent 5-304429, this applicant irradiated the excitation light of wavelength (lambda)0 (for example, 442 nm) with the apparatus using the endoscope etc., and detect the fluorescent image from an organism tissue.

光強度の比率が異なるλ１＝４８０～５２０nmとλ2＝６３０nm以上との２つの蛍光成分を得てλ１，λ２の各帯域間で差、比等の演算処理を行い、この蛍光画像信号の演算結果から例えば正常部は緑、病変部は赤に画像表示するような擬似カラー表示を行うことにより、疾患部位を同定することが可能な蛍光観察装置を提案している。

The fluorescent component of two, (lambda)1 =480 - 520 nm from which the ratio of a fluorescence intensity differs in a normal part and a disease part, and (lambda) 2 = 630 nm or more) were obtained. The difference, and ratio, etc. are numerically processed among each (lambda)1, (lambda)2 band.

The calculation result from, for example, a normal part, of this fluorescent image signal is green, and a disease part is red. In this way, the pseudo- colour display of the image display is performed, and the fluorescent observation apparatus which can identify an illness site is proposed.

【０００７】

[0007]

【発明が解決しようとする課題】

前述のような蛍光観察装置において、観察対象部位の生体組織から得られる蛍光は蛍光強度が弱く、観察対象部位の状態によっては良好な蛍光観察画像が得られない場合が生じる恐れがある。このため、蛍光診断において病変部を見落としたり正常部と病変部の判別を誤ったりなど診断に誤りが生じ、蛍光診断能力が低下してしまう場合がある問題点があった。

[PROBLEM ADDRESSED]

In the above fluorescent observation apparatuses, the fluorescence obtained from the organism tissue of the site for observation has a weak fluorescence intensity.

There is a possibility that the case where a good fluorescent observation image is not obtained according to the state of the site for observation may arise.

For this reason, a disease part is overlooked in fluorescent diagnosis, or an error is generated in diagnoses, such as mistaking distinction of a normal part and a disease part.

There was trouble that the fluorescent-diagnosis capability may reduce.

【０００８】

本発明は、これらの事情に鑑み

[0008]

This invention was made in view of these

てなされたもので、蛍光画像の強度を向上させて観察対象部位の蛍光観察画像の画質を向上させることができ、これにより診断能力を高めることが可能な蛍光観察装置を提供することを目的としている。

situations, can raise strength of the fluorescent image, and can raise the image quality of the fluorescent observation image of the site for observation.

It aims at providing the fluorescent observation apparatus with this raising of diagnostic capability made possible.

【０００９】

[0009]

【課題を解決するための手段】本発明による蛍光観察装置は、観察対象部位の蛍光を得るための励起光を発生する蛍光観察用光源手段と、前記蛍光観察用光源手段からの励起光による励起に基づく観察対象部位の蛍光観察像を撮像する蛍光観察用撮像手段とを備え、蛍光観察画像を表示する装置であって、前記蛍光観察用撮像手段より時系列的に得られる複数の蛍光画像間における画像の動き補償を行う画像動き補償手段と、前記画像動き補償手段によって動き補償が施された複数の蛍光画像を積算する積分手段とを有し、前記積分手段によって積算された画像を蛍光観察画像として表示するものである。

[SOLUTION OF THE INVENTION]

The fluorescent observation apparatus by this invention is equipped with fluorescent light-source means for observation to generate the excitation light for obtaining the fluorescence of the site for observation, and fluorescent image-pick-up means for observation to image-pick up the fluorescent observation image of the site for observation based on the excitation by the excitation light from above-mentioned fluorescent light-source means for observation.

It is the apparatus which displays fluorescent observation image.

Comprising, it has image motion compensation means to perform motion compensation among the fluorescent images received as a time sequence from the above-mentioned fluorescent image-pick-up means for observation, and the integrator which integrates the fluorescent image by the above-mentioned image motion compensation means, and motion compensation was performed.

The image by which integrating was carried out as for the above-mentioned integrator is displayed as fluorescent observation image.

【0010】

[0010]

【作用】

蛍光観察用光源手段によって発生した励起光を観察対象部位に照射し、前記励起光による励起に基づく観察対象部位の蛍光観察像を蛍光観察用撮像手段によって撮像する。そして、画像動き補償手段によって前記蛍光観察用撮像手段より時系列的に得られる複数の蛍光画像間における画像の動き補償を行い、積分手段により前記動き補償が施された複数の蛍光画像を積算した画像を蛍光観察画像として表示する。

[Effect]

The excitation light generated by fluorescent light-source means for observation are irradiated to the site for observation.

The fluorescent observation image of the site for observation based on the excitation by the above-mentioned excitation light is recorded by fluorescent image-pick-up means for observation.

And, motion compensation of the fluorescent images received serially from the above-mentioned fluorescent image-pick-up means for observation by image motion compensation means is performed.

The image which integrated the fluorescent image of some for which above-mentioned motion compensation was performed by the integrator is displayed as the fluorescent observation image.

【0011】

[0011]

【実施例】

以下、図面を参照して本発明の実施例を説明する。図１ないし図４は本発明の第１実施例に係り、図１は蛍光観察装置の全体構成を示す構成説明図、図２は生体組織の観察対象部位における蛍光のスペクトラムを示す特性図、図３は図１の構成におけ

[Embodiment]

Hereafter, the embodiment of this invention is demonstrated with reference to a drawing.

Fig. 1 or 4 concerns the 1st embodiment of this invention.

Diagram 1 is a composition explanatory drawing showing the entire composition of the fluorescent observation apparatus.

Diagram 2 is a characteristic view showing the

る蛍光画像処理装置の機能構成を示すブロック図、図４は蛍光画像処理装置における動作を説明するタイムチャートである。

fluorescent spectrum in the site for observation of an organism tissue.
Diagram 3 is a block diagram showing the function composition of the fluorescent image processing device in the composition of diagram 1.

Diagram 4 is a time chart explaining the operation in a fluorescent image processing device.

【００１２】

本実施例の蛍光観察装置は、観察対象部位への励起光の導光及び観察対象部位からの蛍光の結像を行う内視鏡１を備えている。そして、励起光を発生する蛍光観察用の光源手段として、例えば波長４４２ nm の紫色光を発生するＨｅ－Ｃｄ（ヘリウムーカドミウム）レーザ、３５０ nm～５００ nm のレーザ光を発生するエキシマレーザ、クリプトンレーザ、色素レーザなどのレーザ光発生手段を有するレーザ装置２を備え、また、内視鏡画像を観察するための通常観察用の光源手段として白色光を発生するキセノンランプ等のランプ３ａを有するランプ光源装置３を備えて構成されている。

[0012]

The fluorescent observation apparatus of this embodiment is equipped with the endoscope 1 which performs the fluorescent image formation from the light-guide and the site for the observation of excitation light to the site for observation.

And, it is considered as a light-source means for fluorescent observation to generate excitation light, for example, it has the laser apparatus 2 which has laser light generating means, such as the He-Cd (helium-cadmium) laser which generates a purple light with a wavelength of 442 nm, the excimer laser which generates 350 nm - 500 nm laser light, a krypton laser, and a dye laser.

Moreover, as light-source means for the usual observation for observing an endoscope image, it has the lamp light source device 3 which has lamp 3a, such as the xenon lamp which generates white light, and it is constituted.

【００１３】

内視鏡１は、レーザ装置２あるいはランプ光源装置３からの出

[0013]

The light guide 4 which an endoscope 1 transfers the emitted light from the laser

射光を先端部まで伝達するライトガイド４と、観察像を後端側の接眼部６まで伝達するイメージガイド５とが挿通されており、ライトガイド４は手元側の把持部の側部より延出したユニバーサルコード７内を挿通して端部のライトガイドコネクタ７ａまで延設されている。

apparatus 2 or the lamp light source device 3 to the end, and the image guide 5 which transfers an observation image to the eye-piece part 6 on the rear side are passed through.

Light guide 4 passes through the inside of the universal cord 7 extended from the side of the holding part on the operator side, and is installed to light-guide connector 7a of an edge part.

【００１４】

レーザ装置２及びランプ光源装置３は、内視鏡１へ導く光を切り換える配光用アダプタ８に接続され、配光用アダプタ８には前記内視鏡１のライトガイドコネクタ７ａが接続されて、レーザ装置２からのレーザ光による励起光あるいはランプ光源装置３からの通常観察用照明光が配光用アダプタ８を介して内視鏡のライトガイド４へ導かれ、内視鏡１の先端部より出射されるようになっている。

[0014]

The laser apparatus 2 and the lamp light source device 3 are connected to the adaptor for light distributions 8 which switches the light guided to endoscope 1.

Light-guide connector 7a of the above-mentioned endoscope 1 was connected to the adaptor for light distributions 8.

The excitation light by the laser light from the laser apparatus 2 or the usual illumination light for observation from the lamp light source device 3 is guided to the light guide 4 of an endoscope via the adaptor for light distributions 8, and it radiates from the end of endoscope 1.

【００１５】

前記配光用アダプタ８は、レーザ装置２及びランプ光源装置３の出射光の光路中に配設された可動ミラー９と、可動ミラー９を駆動するドライバ１０とにより構成された照明光切換手段１１を備えており、可動ミラー９の角度を選択的に切り換えることによって励起光あるいは通常観察用照明光を内視鏡のライト

[0015]

The above-mentioned adaptor for light distributions 8 is equipped with illumination light switching means 11 constituted by the movable mirror 9 arranged in the optical path of the emitted light of the laser apparatus 2 and the lamp light source device 3, and the driver 10 which actuates the movable mirror 9.

Excitation light or the usual illumination light for observation is guided to the light-guide 4 rear-end surface of an endoscope by switching

ガイド４後端面へ導くようになっている。

the angle of the movable mirror 9 selectively.

【００１６】
内視鏡１の接眼部６には、受光用アダプタ１２が接続され、この受光用アダプタ１２には通常画像受信部であって通常観察用撮像手段となる通常観察用カメラ１３と蛍光画像受信部であって蛍光観察用撮像手段となる蛍光観察用カメラ１４とが接続され、各々の撮像手段によって通常観察像及び蛍光観察像が撮像されるようになっている。通常観察用カメラ１３は、結像光学系と、撮像素子としてのＣＣＤ１５とを備え、ランプ光源装置３からの通常観察用照明光で照射された被検部位の像（通常観察像）を撮像するようになっている。

[0016]
The adaptor for light receptions 12 is connected to the eye-piece part 6 of an endoscope 1.
The camera for usual observation 13 which is a usual image receiving part and becomes this adaptor for light receptions 12 with usual image-pick-up means for observation, and the fluorescent camera for observation 14 which is a fluorescent image receiving part and serves as fluorescent image-pick-up means for observation are connected.

A usual observation image and fluorescent observation image are registered by each image-pick-up means.

The camera for usual observation 13 is equipped with an image-formation optical system and CCD15 as an image-pick-up element.

The image (usual observation image) of the tested site irradiated with the usual illumination light for observation from the lamp light source device 3 is recorded.

【００１７】
蛍光観察用カメラ１４は、結像光学系と、所定の帯域の蛍光成分を通過させる回転フィルタ１６と、回転フィルタ１６を回転駆動する駆動用モータ１７と、回転フィルタ１６を透過した像を増幅するイメージインテンシファイア（I.I.）１８と、イメージインテンシファイア１８の出

[0017]
The fluorescent camera for observation 14, an image-formation optical system and the rotating filter 16 which passes the fluorescent component of a predetermined band, the motor for actuation 17 which carries out rotation actuation of the rotating filter 16, and the image intensifier 18 which amplifies the image which permeated the rotating filter 16 (I. I.), it has CCD19 as an image-pick-up element which

力像を撮像する撮像素子としてのＣＣＤ１９とを備え、レーザ装置２からの励起光を照射することによって得られる被検部位の蛍光像（蛍光観察像）を撮像するようになっている。回転フィルタ１６は、例えばλ１＝４８０～５２０nmの帯域通過フィルタとλ２＝６３０nm以上の帯域通過フィルタとが配設されて円盤状に形成され、回転することによってこれらのフィルタが順次光路中に介挿され、λ１，λ２のそれぞれの帯域の蛍光成分を通過させるようになっている。

records the output image of the image intensifier 18.

The fluorescent image (fluorescent observation image) of the tested site obtained by irradiating the excitation light from the laser apparatus 2 is recorded.

The rotating filter 16 is (lambda)1 =480 - 520 nm band pass filter, for example, and the band pass filter more than (lambda)2 =630 nm is arranged, and it forms a disc-shape.

These filters are sequentially placed in the optical path by rotating.

The fluorescent component of each band of (lambda) 1 and (lambda)2 are passed.

【００１８】

受光用アダプタ１２は、内視鏡の接眼部６へ伝送された被写体像の光路中に配設された可動ミラー２０と、可動ミラー２０を駆動するドライバ２１とにより構成された撮像切換手段２２を備えており、可動ミラー２０の角度を選択的に切り換えることによって蛍光観察用と通常観察用とにカメラを切り換え、内視鏡１で得られた被写体像を通常観察用カメラ１３あるいは蛍光観察用カメラ１４へ導くようになっている。

[0018]

The adaptor for light receptions 12 has the movable mirror 20 arranged in the optical path of the copied object image transmitted to the eye-piece part 6 of an endoscope, the driver 21 which actuates the movable mirror 20, and image-pick-up switching means 22.

A camera is switched to the fluorescent object for observation, and a usual observation by switching the angle of the movable mirror 20 selectively.

The copied object image obtained by the endoscope 1 is guided to the camera for usual observation 13, or the fluorescent camera for observation 14.

【００１９】

前記通常観察用カメラ１３にはカメラコントロールユニット

[0019]

The camera control unit (CCU) 23 is connected to the above-mentioned camera for usual

（ＣＣＵ）２３が接続され、ＣＣＤ１５の出力の撮像信号（通常画像信号）が入力されてＣＣＵ２３で信号処理がなされ、通常観察画像のビデオ信号が生成されるようになっている。

observation 13.
The image-pick-up signal (usual image signal) of the output of CCD15 is input, and signal processing is performed by CCU23, and the video signal of a usual observation image forms.

【００２０】
前記蛍光観察用カメラ１４には蛍光画像処理手段となる蛍光画像処理装置２４が接続され、ＣＣＤ１９の出力である蛍光画像の撮像信号（蛍光画像信号）が入力されて蛍光画像処理装置２４で信号処理がなされ、蛍光観察画像のビデオ信号が生成されるようになっている。

[0020]
The fluorescent image processing device 24 used as fluorescent image-processing means is connected to the above-mentioned fluorescent camera for observation 14.
The image-pick-up signal (fluorescent image signal) of the fluorescent image which is the output of CCD19 is input, and a signal processing is made by the fluorescent image processing device 24, and the video signal of fluorescent observation image forms.

【００２１】
また、各部の動作タイミングを制御するタイミングコントローラ２５が設けられ、配光用アダプタ８のドライバ１０，受光用アダプタ１２のドライバ２１，回転フィルタ１６の駆動用モータ１７，及び蛍光画像処理装置２４へタイミング制御信号を送出するようになっている。

[0021]
Moreover, the timing controller 25 which controls timing of each part of operation is provided.
A timing-control signal is sent out to the driver 10 of the adaptor for light distributions 8, the driver 21 of the adaptor for light receptions 12, the motor for actuation 17 of the rotating filter 16, and the fluorescent image processing device 24.

【００２２】
前記ＣＣＵ２３及び蛍光画像処理装置２４はビデオスイッチャ２６に接続され、ＣＣＵ２３の出力の通常観察画像信号と蛍光画像処理装置２４の出力の蛍光

[0022]
Above-mentioned CCU23 and the above-mentioned fluorescent image processing device 24 are connected to the video switcher 26.
The usual observation image signal of the output of CCU23 and the fluorescent

観察画像信号とがビデオスイッチャ２６によって選択的に切換えられるようになっている。ビデオスイッチャ２６には、手動により画像切換え制御を行うためのフットスイッチ２７と、蛍光画像処理装置２４の演算結果に基づいて自動的に画像切換え制御を行うためのビデオスイッチングコントローラ２８とが接続されている。ビデオスイッチャ２６の出力端にはモニタ２９が接続され、ビデオスイッチャ２６によって選択された蛍光観察画像信号または通常観察画像信号がモニタ２９に入力されて蛍光観察画像または通常観察画像が表示されるようになっている。

observation image signal of the output of the fluorescent image processing device 24 switch selectively by video switcher 26.

The foot switch 27 for manual operation performing an image change control and the video switching controller 28 for performing an image change control automatically based on the calculation result of the fluorescent image processing device 24 are connected to the video switcher 26.
A monitor 29 is connected to the output end of the video switcher 26.

The fluorescent observation image signal chosen by the video switcher 26 or a usual observation image signal is input into monitor 29, and fluorescent observation image or a usual observation image is displayed.

【００２３】
本実施例の蛍光観察装置において観察を行う際には、タイミングコントローラ２５からのタイミング制御信号の指示によって、配光用アダプタ８，受光用アダプタ１２によりそれぞれ光源及びカメラを切り換え、蛍光観察または通常観察を選択する。このとき、タイミングコントローラ２５は、蛍光画像処理装置２４内での処理と、配光用アダプタ８の可動ミラー９，受光用アダプタ１２の可動ミラー２０，蛍光観察用カメラ１４の回転フィルタ１６の各動作との

[0023]
In case it observes in the fluorescent observation apparatus of this embodiment, a light source and a camera are respectively switched by the adaptor for light distributions 8, and the adaptor for light receptions 12 the indication of the timing-control signal from the timing controller 25, and a fluorescent observation or a fluorescent usual observation is chosen.

At this time, the timing controller 25 takes the synchronization with a process within the fluorescent image processing device 24, and each operation of the movable mirror 9 of the adaptor for light distributions 8, the movable mirror 20 of the adaptor for light receptions 12,

同期をとる。

and the rotating filter 16 of the fluorescent camera for observation 14.

【００２４】

通常観察の場合には、図１において実線で示すような位置に可動ミラー９，２０を移動させる。これにより、内視鏡１のライトガイド４には配光用アダプタ８を介してランプ光源装置３からの通常観察用照明光が導かれ、観察対象部位へ照射される。このとき、ランプ３ａからの通常観察用照明光により照明された被写体像（通常観察像）は、イメージガイド５を通り受光用アダプタ１２を経て通常観察用カメラ１３へ導かれて撮像される。そして、ＣＣＤ１５で撮像された通常画像の撮像信号がＣＣＵ２３で信号処理され、通常観察画像信号としてビデオスイッチャ２６へ送出される。

[0024]

The movable mirrors 9 and 20 are made to move to the position which is shown as a continuous line in diagram 1 in the case of usual observation.

Thereby, the usual illumination light for observation from the lamp light source device 3 is guided to the light guide 4 of an endoscope 1 via the adaptor for light distributions 8, and it is irradiated to the site for observation.

The copied object image illuminated by the usual illumination light for observation from lamp 3a at this time (usual observation image), through the image guide 5, through the adaptor for light receptions 12, it guides to the camera for usual observation 13, and it records.

And, the signal processing of the image-pick-up signal of the usual image recorded by CCD15 is carried out by CCU23.

It is sent out as a usual observation image signal to the video switcher 26.

【００２５】

一方、蛍光観察の場合には、図１において破線で示すような位置に可動ミラー９，２０を移動させる。これにより、内視鏡１のライトガイド４には配光用アダプタ８を介してレーザ装置２からの励起光が導かれ、観察対象部位へ照射される。このとき、励起光を照射することによって得られる被検部位の蛍光像（蛍

[0025]

On the one hand, the movable mirrors 9 and 20 are made to move to the position which is shown with a broken line in diagram 1 in the fluorescent observation.

Thereby, the excitation light from the laser apparatus 2 are guided to the light guide 4 of an endoscope 1 via the adaptor for light distributions 8, and it is irradiated to the site for observation.

For the fluorescent image of the tested site

光観察像）は、イメージガイド５を通り受光用アダプタ１２を経て蛍光観察用カメラ１４へ導かれて撮像される。蛍光観察用カメラ１４において、回転フィルタ１６により前記λ１，λ２の波長帯域の蛍光成分が透過され、イメージインテンシファイア１８で蛍光像が増幅されてＣＣＤ１９で撮像される。ＣＣＤ１９で撮像されて得られた蛍光画像の撮像信号が蛍光画像処理装置２４で信号処理され、蛍光観察画像信号としてビデオスイッチャ２６へ送出される。

obtained by irradiating excitation light at this time (fluorescent observation image), through the image guide 5, through the adaptor for light receptions 12, it guides to the fluorescent camera for observation 14, and it records.

In the fluorescent camera for observation 14, the fluorescent component of above-mentioned (lambda)1, (lambda)2 wavelength band is permeated with the rotating filter 16.

The fluorescent image is amplified by the image intensifier 18, and it records by CCD19.

The signal processing of the image-pick-up signal of the fluorescent image recorded and obtained by CCD19 is carried out by the fluorescent image processing device 24.

It is sent out as fluorescent observation image signal to the video switcher 26.

【００２６】

本実施例では、タイミングコントローラ２５は、前記通常観察及び蛍光観察の２つの状態を高速で切換えている。この結果、ビデオスイッチャ２６には、常に通常観察画像信号と蛍光観察画像信号との両方が送られる。

[0026]

In this embodiment, the timing controller 25 has switched the state of the two of the above-mentioned usual observation and fluorescent observation at high speed.

Consequently, both usual observation image signal and fluorescent observation image signals are always sent to the video switcher 26.

【００２７】

このビデオスイッチャ２６に入力された通常観察画像及び蛍光観察画像の２つの画像をモニタ２９に表示する方法としては、フットスイッチ２７からの指示により画像を選択的に切り換えて表示する方法、蛍光画像処理

[0027]

As the process of displaying the image of the two of the usual observation image input into this video switcher 26, and fluorescent observation image to monitor 29, when identifying illness sites, such as that of cancer, by the control of the video switching controller 28 based on the process which an image is

装置２４の演算結果に基づいてビデオスイッチングコントローラ２８の制御により例えば癌等の疾患部位を識別したときに蛍光画像を表示するように画像を切換える方法、ビデオスイッチャ２６において蛍光観察画像及び通常観察画像を合成して２つの画像をスーパーインポーズ表示したり所定の態様に合成表示する方法などが挙げられる。

selectively switched by the indication from a foot switch 27, and is displayed, and the calculation result of the fluorescent image processing device 24, for example, the method to switch the image so that the fluorescent image may be displayed, in the video switcher 26, fluorescent observation image and a usual observation image are synthesised, and a method to superimpose the 2 images into a synthetic display at a predetermined aspect, these etc. are mentioned.

【００２８】
蛍光観察を行う場合、レーザ装置２のレーザ光発生手段としてＨｅ－Ｃｄレーザによるλ０＝４４２nmの紫色光を生体組織に照射すると、４４２nmより長い波長の自家蛍光が発生するので、この蛍光像を蛍光観察用カメラ１４において回転フィルタ１６でλ１＝４８０～５２０nmとλ２＝６３０nm以上との２つの波長領域に分離透過してλ１とλ２の２つの蛍光像を順次撮像する。

[0028]
If (lambda)0 =442 nm purple light by the He-Cd laser is irradiated to an organism tissue as laser light generating means of the laser apparatus 2 when performing fluorescent observation, since the self-fluorescence of a wavelength longer than 442 nm occurs, this fluorescent image, concerning the fluorescent camera for observation 14.

By the rotating filter 16, (lambda)1 =480 - 520 nm, separation permeation is carried out also to the wavelength area of more than (lambda)2 =630 nm. The two fluorescent images of (lambda)1 and (lambda)2 are sequentially recorded.

【００２９】
前記紫色光の励起光による観察対象部位における可視領域の蛍光のスペクトラムは、図２に示すように、励起光λ０より長い波長の帯域の強度分布となり、正常部位では強く、癌などの病変部では弱くなり、特にλ１付

[0029]
The fluorescent spectrum of the visualisation area in the site for observation by the excitation light of the above-mentioned purple light serves as a strength distribution of the band of a wavelength longer than excitation-light (lambda)0, as shown in diagram 2.

It is strong at a normal site.

近の帯域では正常部位における蛍光強度が強く、病変部との差が大きくなる。よって、特にλ1付近の蛍光強度から正常部位と病変部との判別が可能であり、このような蛍光画像によって癌等の病変部の診断ができる。

In disease parts, such as that of cancer, it becomes weak.

The fluorescence intensity in a normal site is especially strong in the band near (lambda)1, and the difference with a diseased part becomes large.

Therefore, the distinction with a normal site and a disease part is especially possible from the fluorescence intensity near (lambda)1, and a diagnosis of diseased parts, such as cancer, can be performed by such fluorescent image.

【００３０】

蛍光画像処理装置２４においては、例えばλ１とλ２の蛍光像の画像信号よりλ１とλ２における蛍光強度の比率または差分を求める演算を行い、生体組織の性状を判別可能な蛍光観察画像信号を生成する。

[0030]

In the fluorescent image processing device 24, the calculation which asks for the ratio or the difference of a fluorescence intensity in (lambda)1 and (lambda)2 from the image signal of the fluorescent image of (lambda)1 and (lambda)2 is performed.

The fluorescent observation image signal which can distinguish the characteristic of an organism tissue is formed.

【００３１】

次に、図３に蛍光画像処理装置２４の詳細の構成を示し、蛍光画像処理装置２４の構成及び作用について説明する。なお、図３には蛍光画像処理装置２４における蛍光画像の動き補償処理及び積分処理を行う部分の機能構成を示す。

[0031]

Next, the detailed composition of the fluorescent image processing device 24 is shown in diagram 3.

The composition and effects of the fluorescent image processing device 24 are demonstrated.

In addition, the function composition of the part which performs a motion compensation process and an integrating process of the fluorescent image in the fluorescent image processing device 24 is shown in diagram 3.

【００３２】
蛍光画像処理装置２４は、装置内の各部を制御する制御部５１、時系列的に入力される蛍光画像の信号を２系統に切換えるマルチプレクサ５２、蛍光画像を記憶するフレームメモリ５３，５４，５７，５８、フレームメモリ５３及び５４に記憶された蛍光画像より画像の動きベクトル等を検出して蛍光画像の動き補償を行う画像動き補償手段としての動き補償回路５５、動き補償処理されフレームメモリ５７に記憶された蛍光画像をフレームメモリ５８の画像に積算する積分手段としての積分回路５６、積分処理されフレームメモリ５８に記憶された蛍光画像の信号レベルを検出し所定のレベルに達したかを判断すること等によって蛍光画像の所定の特徴量を検出する特徴量検出手段であってレベル検出手段となるレベル検出回路５９を備えて構成されている。

[0032]
The fluorescent image processing device 24 detects the motion vector of an image etc. from the fluorescent image stored by the control part 51 which controls each part in an apparatus, the multiplexer 52 which switches the signal of a fluorescent image input into a time sequential series of two lines, frame-memory 53,54,57,58 which store the fluorescent images, and the frame memories 53 and 54.
The motion compensating circuit 55 as image motion compensation means to perform motion compensation of the fluorescent image, the integration circuit 56 as an integrator which integrates the fluorescent image which the motion compensation process was carried out and was stored by the frame memory 57 to the image of frame memory 58, by judging whether the signal level of the integrating fluorescent image which was processed and was stored by the frame memory 58 was detected, and the predetermined level was reached etc., it has the level detector circuit 59 which is amount detection means of the characteristics to detect the predetermined amount of the characteristics of a fluorescent image, and it serves as the level detection means.

【００３３】
この構成において、蛍光画像処理装置２４は蛍光画像の動き補償処理及び積分処理を行い、蛍光画像の信号レベルが所定値以上となるように蛍光画像の強度を向上させる。

[0033]
In this composition, the fluorescent image processing device 24 performs a motion compensation process and an integrating process on the fluorescent image.
Strength of a fluorescent image is raised so that the signal level of a fluorescent image may become larger than a specified value.

【００３４】
制御部５１は、タイミングコントローラ２５からのタイミング制御信号に基づいて、蛍光画像処理装置２４内の各部に各種制御信号を送出し、装置内の構成要素の動作を制御する。

[0034]
The control part 51 is based on a timing-control signal from the timing controller 25. various control signals are sent out to each part in the fluorescent image processing device 24.

An operation of the constructor in an apparatus is controlled.

【００３５】
蛍光観察用カメラ１４からの蛍光画像信号は、マルチプレクサ５２に時系列的に入力され、マルチプレクサ５２によって出力先が切換えられてフレームメモリ５３またはフレームメモリ５４に記憶される。なお、初めのタイミングでは、フレームメモリ５３に画像が記憶される。この画像が蛍光画像の動き補償を行う際の基本画像となる。このとき、出力側のフレームメモリ５８にも同じ画像が記憶される。

[0035]
The fluorescent image signal from the fluorescent camera for observation 14 is input in a time sequence into multiplexer 52.

An output destination is switched by the multiplexer 52 and the frame memory 53 or the frame memory 54 stores it.

In addition, an image is stored by the frame memory 53 according to the first timing.

It becomes the basic image at the time of performing image motion compensation of a fluorescent image.

At this time, the same image also as the frame memory 58 on the output side is stored.

【００３６】
マルチプレクサ５２には所定のタイミング毎に蛍光画像が入力され、前記基本画像よりも時間的に後に入力された蛍光画像がフレームメモリ５４に記憶され、動き補償回路５５によってフレームメモリ５３の基本画像とフレームメモリ５４の画像とを対比することにより、蛍光画像の動き補償処理が行われる。

[0036]
A fluorescent image is input into multiplexer 52 at every predetermined timing.

The fluorescent image input later in time than the above-mentioned basic image is stored in the frame memory 54.

A motion compensation process of a fluorescent image is performed by contrasting the basic image of a frame memory 53, and the image of a frame memory 54 by the motion compensating circuit 55.

動き補償回路５５では、例えば基本画像に対するフレームメモリ５４の画像の動きベクトルを検出し、画像の所定の部分の座標が一致するようにフレームメモリ５４の蛍光画像の動き補償を行う。

In the motion compensating circuit 55, the motion vector of the image of the frame memory 54 in relation to the basic image is detected, for example.

Motion compensation of the fluorescent image of a frame memory 54 is performed so that the coordinates of the predetermined part of an image may be in agreement.

【００３７】

前記動き補償回路５５によって動き補償処理が施されたフレームメモリ５４の蛍光画像はフレームメモリ５７に記憶される。そして、積分回路５６によって、フレームメモリ５３の基本画像と動き補償処理が施されてフレームメモリ５７に記憶された蛍光画像（被動き補償画像）とが積算され、フレームメモリ５８に記憶される。すなわち、フレームメモリ５８において、初めに記憶された基本画像にフレームメモリ５７の被動き補償画像が加算されることになる。

[0037]

The fluorescent image of the frame memory 54 for which the motion compensation process was performed by the above-mentioned motion compensating circuit 55 is stored by in frame memory 57.

And, integrating of the fluorescent image (motion compensation image) which the motion compensation process was performed by the integration circuit 56 with the basic image of a frame memory 53, and was stored by the frame memory 57 by it is carried out, and it stores in frame memory 58.

That is, in frame memory 58, the image of frame memory 57 having been motion compensated will be added to the basic image stored first.

【００３８】

この積分処理にかかる蛍光画像処理装置２４の動作の概念図を図４に示す。ここでは簡単のため蛍光画像を１次元信号とみなして表している。図４の（ａ）のマルチプレクサ５２に入力される蛍光画像のうち、基本画像に対して後に入力される画像は

[0038]

The conceptual diagram of the operation of such a fluorescent image processing device 24 to this integrating process is shown in diagram 4.

Here, for simplicity, it considers that the fluorescent image is a one-dimensional signal.

Among the fluorescent image input into the multiplexer 52 of (a) in the diagram 4, as for the

動き補償回路５５で動き補償処理が施され、図４の（ｂ）のように積分回路５６によりフレームメモリ５８において基本画像に被動き補償画像が積算されていく。

【００３９】

フレームメモリ５８の蛍光画像は、複数の画像が積算されて出力され、例えば積算された蛍光画像の信号レベルが所定のレベルに達すると１回の積算が終了し、次の画像から新たに積算が開始される。本実施例では、レベル検出回路５９の検出結果に応じて、蛍光画像が所定のレベルＶ　１以上となったときに１回の画像積分処理を終了するようになっている。図４では積算する画像の数が４になった場合の例を示している。すなわち、時系列的に入力される蛍光画像が動き補償処理を施された後に積算され、４つの画像が積算されて所定のレベルＶ　１を超えると積算動作が終了し、積算された蛍光画像がフレームメモリ５８より出力される。１回の画像積分処理が終了すると、次に入力される蛍光画像が基本画像としてフレームメモリ５３及び５８に記憶され、同様の処理が繰り返される。なお、蛍光画像の積算回数は、あらかじめ設定

image later input in relation to the basic image, a motion-compensation process is performed in the motion-compensation circuit 55.

As shown in (b) in the diagram 4, in the frame memory 58, integrating of the motion-compensated image is carried out into the basic image by the integration circuit 56.

[0039]

For the fluorescent image of frame memory 58, Integrating of some images is carried out and they are output.

For example, if the signal level of the fluorescent image by which integrating was carried out reaches a predetermined level, 1 cycle of integrating will be completed, and integrating is newly started from the following image.

In this embodiment, when a fluorescent image becomes more than predetermined level V1 depending on the detection result of the level detector circuit 59, one image integral process is completed.

Diagram 4 shows the example when the number of the images to integrate is set to 4.

That is, integrating is carried out after performing a motion-compensation process to the fluorescent image input in a time sequence.

An integrating operation will be completed, if integrating of the four images is carried out and it exceeds predetermined level V1.

The fluorescent image by which integrating was carried out is output from frame memory 58.

If one image integral process is completed, the fluorescent image input into the next will be

した固定の回数としても良い。

stored in frame memories 53 and 58 as a basic image, and the same process is repeated.

In addition, the frequency of integrating of a fluorescent image is good also as the fixed frequency set up beforehand.

【００４０】

レベル検出回路５９では、フレームメモリ５８の蛍光画像の信号レベルを検出し、検出結果に応じてビデオ切換え制御信号をビデオスイッチングコントローラ２８へ出力する。本実施例では、図４の（ｂ）に示すようにレベル検出回路５９においてフレームメモリ５８の積算された蛍光画像が所定のレベルＶ １を越えたか否かを判断し、蛍光画像が所定のレベルＶ １以上となったときにビデオ切換え制御信号を出力するようになっている。このビデオ切換え制御信号により、ビデオスイッチングコントローラ２８によってビデオスイッチャ２６におけるビデオ信号の切換えが制御され、図４の（ｃ）に示すように蛍光画像が所定のレベルＶ １以上となった場合にビデオスイッチャ２６において最終的な蛍光観察画像信号として出力される。なお、前記ビデオ切換え制御信号によって通常観察画像表示と蛍光観察画像表示の切換えを行うことも可能である。

[0040]

In the level detector circuit 59, the signal level of the fluorescent image of a frame memory 58 is detected.

A video switching control signal is output to the video switching controller 28 depending on the detection result.

In this embodiment, it judges whether the fluorescent image to which integrating of the frame memory 58 was carried out in the level detector circuit 59 as shown in (b) in the diagram 4 exceeded the predetermined level V1.

When the fluorescent image becomes more than the predetermined level V1, a video change control signal is output.

A change of the video signal in the video switcher 26 is controlled by this video change control signal by the video switching controller 28.

As shown in (c) in the diagram 4, when a fluorescent image becomes more than predetermined level V1, it is output to the video switcher 26 as a final fluorescent observation image signal.

In addition, it is also possible to perform a change of a usual observation image display and fluorescent observation image display with the above-mentioned video change control signal.

【0041】
このように、複数の蛍光画像間で動き補償処理を施した後に、これらの画像を積算した結果を蛍光観察画像として出力しモニタ２９に表示することにより、蛍光画像の強度が向上し、蛍光信号レベルに対するノイズレベルを低下させることができる。この結果、蛍光観察画像の画質が向上し、蛍光観察による診断能力を向上させることができる。

[0041]
Thus, after performing a motion-compensation process among some fluorescent images, strength of the fluorescent image improves by outputting it, using the result which integrated these images as fluorescent observation image, and displaying in the monitor 29.

The noise level opposing to a fluorescent signal level can be made to reduce.
Consequently, the image quality of fluorescent observation image improves.

The diagnostic capability by fluorescent observation can be raised.

【0042】
なお、本実施例では複数の画像を積算した結果を蛍光観察画像として表示するため、画像表示の時間分解能は積算した分だけ低下することになる。しかしながら内視鏡を用いた蛍光観察装置においては、通常、観察時に画像受光部を持つ内視鏡先端部を高速で動かすことはないため、時間分解能低下による病変部見逃し等の問題が生じる可能性は極めて小さい。

[0042]
In addition, in this embodiment, in order to display the result which integrated some images, as fluorescent observation image, only a part for the temporal resolution of an image display to have integrated will reduce.

However in the fluorescent observation apparatus using the endoscope, in order not to move at high speed the endoscope end which has an image light-reception part usually at the time of an observation, , the possibility that problems, such as the disease part being overlooked by temporal-resolution reduction, being generated is very small.

【0043】
以上のように本実施例によれば、蛍光画像の強度を向上させて観察対象部位の蛍光観察画像の画質を向上させることができ、誤りの少ない、より精度の

[0043]
As mentioned above, according to this embodiment, strength of the fluorescent image can be raised and the image quality of the fluorescent observation image of the site for observation can be raised.

高い診断を行うことが可能であり、蛍光診断能力を高めることができる効果がある。

The thing with few errors which an accurate diagnosis is performed is more possible, and the fluorescent-diagnosis capability can be raised.

The above-mentioned effect is expectable.

【００４４】

図５は本発明の第２実施例に係る蛍光観察装置における蛍光画像処理装置の機能構成を示すブロック図である。

[0044]

Diagram 5 is a block diagram showing the function composition of the fluorescent image processing device in the fluorescent observation apparatus based on the second embodiment of this invention.

【００４５】

第２実施例は蛍光画像処理装置における蛍光画像の動き補償処理及び積分処理を行う部分の機能構成の変形例である。ここでは前述した第１実施例と異なる部分のみ説明し、他の同様な部分の説明は省略する。

[0045]

A second embodiment is a modification of the function composition of the part which performs a motion compensation process and an integrating process of the fluorescent image in a fluorescent image processing device.

Here, only the part different from the 1st embodiment mentioned above is demonstrated, and description of the other same parts is omitted.

【００４６】

第２実施例の蛍光画像処理装置２４ａにおいては、第１実施例の構成に加えて、動き補償回路５５で動き補償処理の際に求めた画像の動きベクトルの総量を検出する特徴量検出手段であって動きベクトル検出手段となる動きベクトル総量検出回路６０と、動きベクトル総量検出回路６０の検出結果に基づく制御部５１の制御出力とレベル検出回

[0046]

In fluorescent image-processing-device 24a of the second embodiment, adding to the composition of the 1st embodiment, it is amount detection means of the characteristics to detect the total amount of the motion vector of the image searched for in the motion-compensation circuit 55 at the time of a motion-compensation process.

The motion vector total-amount detector circuit 60 used as motion vector detection means, OR circuit 61 which takes the logical

路５９の制御出力との論理和をとるＯＲ回路６１とを備えている。

sum of the control output of the control part 51 and the control output of the level detector circuit 59 based on the detection result of the motion vector total-amount detector circuit 60. It has these.

【００４７】

この構成において、動きベクトル総量検出回路６０は、動き補償回路５５での動き補償処理において発生する動きベクトルを検出し、動きベクトル総量を算出、記憶する。ここで、動きベクトル総量があらかじめ定められた条件を満たした場合、例えば画像の動きが大きく所定値以上のベクトル量となった場合には、動きベクトル総量検出回路６０は制御部５１へベクトル検出信号を出力する。制御部５１は、このベクトル検出信号を受けて、ビデオ切換え制御信号をＯＲ回路６１に出力すると共に、画像積分処理を終了して積算された蛍光画像をフレームメモリ５８より出力する。

[0047]

In this composition, the motion vector total-amount detector circuit 60 detects the motion vector generated in the motion compensation process by the motion compensating circuit 55, and the motion vector total amount is computed and stored.

When the conditions whereby the motion vector total amount predetermined are fulfilled here, when a motion of an image becomes the vector quantity greatly beyond a specified value, for example The motion vector total-amount detector circuit 60 outputs a vector detecting signal to the control part 51, and the control part 51 receives this vector detecting signal.

While outputting a video change control signal to OR circuit 61, the fluorescent image by which integrating was carried out by completing an image integral process is output from frame memory 58.

【００４８】

ＯＲ回路６１では、制御部５１の制御出力とレベル検出回路５９の制御出力との論理和がとられ、制御部５１とレベル検出回路５９の少なくともいずれか一方よりビデオ切換え制御信号が出力されるとＯＲ回路６１を介

[0048]

In OR circuit 61, the logical sum of the control output of the control part 51 and the control output of the level detector circuit 59 is taken.

By at least one of control part 51 and level detector circuit 59 , if the video change control signal is output, it will be sent out via OR circuit 61 to the video switching controller 28.

してビデオスイッチングコントローラ２８へ送出される。

【００４９】
その他の部分の作用は第１実施例と同様であり、説明を省略する。

[0049]
The effect of other parts is the same as that of the 1st embodiment, and description is omitted.

【００５０】
内視鏡を用いた蛍光観察装置によって得られる蛍光画像の動きベクトル総量は、内視鏡先端部の移動速度に応じて変化する。従って、動きベクトル総量に基づいて蛍光画像の積算枚数を決定することにより、内視鏡の移動速度に応じた適切な蛍光観察画像を得ることができる。

[0050]
The motion vector total amount of the fluorescent image obtained with the fluorescent observation apparatus using the endoscope varies depending on the moving speed of the endoscope end.

Therefore, a suitable fluorescent observation image can be obtained depending on the moving speed of an endoscope by deciding the integrating number of images of a fluorescent image based on the motion vector total amount.

【００５１】
より具体的には、内視鏡を被検部位へ挿入する時、または観察位置を大きく動かす時など、観察に注力していない時においては、内視鏡先端部を速く移動させる場合がある。このような場合には、積分する画像の数を減らすことにより、蛍光画像の示す観察部位が大きく動くことを防止する。この結果、予想外の病変部の存在を見逃す恐れを回避できる。

[0051]
More specifically, when inserting an endoscope to the test location, or when moving an observation position greatly and an observation is not concentrated on, , the endoscope end may be made to move quickly.

In such a case, it prevents that the observation site which a fluorescent image shows moves greatly by reducing the number of the images to integrate.

Consequently, a possibility that it may overlook existence of an unexpected disease part is avoidable.

【００５２】
このように、本実施例によれば、

[0052]
Thus, while according to this embodiment a

蛍光画像を積算することにより蛍光信号レベルを増加させて蛍光観察画像の画質を向上させることができると共に、画像の動きに応じた適切な積分処理を行って蛍光画像を表示することにより蛍光画像が大きく動くことを防止することができ、病変部見逃し等を防止して蛍光診断能力を向上させることができる。

fluorescent signal level can be made to be able to increase and the image quality of fluorescent observation image can be raised by carrying out integrating of the fluorescent image, it can prevent that a fluorescent image moves greatly by performing a suitable integrating process depending on the motion of an image, and displaying the fluorescent image.

Disease part overlooking etc. can be prevented and the fluorescent-diagnosis capability can be raised.

【0053】

図６及び図７は本発明の第３実施例に係り、図６は蛍光観察装置における蛍光画像処理装置の機能構成を示すブロック図、図７は蛍光画像処理装置における動作を説明するタイムチャートである。

[0053]

Fig. 6 and 7 concerns the 3rd embodiment of this invention.

Diagram 6 is a block diagram showing the function composition of the fluorescent image processing device in fluorescent observation apparatus. diagram 7 is a time chart explaining the operation in the fluorescent image processing device.

【0054】

第３実施例は、蛍光画像処理装置における蛍光画像の動き補償処理及び積分処理を行う部分の機能構成において複数の系統の回路を備えた構成例である。

[0054]

A 3rd embodiment is an example of composition equipped with the circuit of some systems in the function composition of the part which performs a motion compensation process and an integrating process of the fluorescent image in a fluorescent image processing device.

【0055】

第３実施例の蛍光画像処理装置２４ｂにおいては、フレームメモリ５３，５４，５７，５８、動き補償回路５５、積分回路５

[0055]

In fluorescent image-processing-device 24b of the 3rd embodiment, it has two or more sets of the same constructors as the 1st embodiment shown in diagram 3 constituted in frame-

6、レベル検出回路59により構成される図3に示した第1実施例と同様の構成要素を複数組備えている。そして、装置内の各部の動作を管理、制御する制御部65を有し、蛍光画像の入力側と出力側にそれぞれ信号の切換えを行う入力用マルチプレクサ66と出力用マルチプレクサ67とが設けられている。すなわち、蛍光画像の動き補償処理及び積分処理を実行する信号ラインが複数系統（n系統、ただしnは2以上の整数）設けられて構成されている。

memory 53,54,57,58, the motion compensating circuit 55, the integration circuit 56, and level detector circuit 59.

And, it has the control part 65 which manages and controls operation of each part in an apparatus.

The multiplexer for the input 66 and the multiplexer for the output 67 which respectively switch a signal to the input side of a fluorescent image and an output side are provided.

Namely, two or more signal lines perform a motion-compensation process and an integrating process of a fluorescent image. (n lines.) While, n is an integer 2 or greater.

These can be provided and it is constituted.

【0056】
各系統における動き補償処理及び積分処理の動作は第1実施例と同様であり、ここでは説明を省略する。

[0056]
The operation of the motion compensation process in each system and an integrating process is the same as that of the 1st embodiment.

Here, description is omitted.

【0057】
本実施例では、動き補償処理及び積分処理を施す蛍光画像の数があらかじめ設定されており、この数をm（ただしmは2以上の整数）とする。簡単のため、蛍光画像処理装置24bにおける動き補償処理及び積分処理を実行する構成要素の系統数nをmに等しいとする。また、マルチプレクサ66に蛍光画像が入力される時間間隔をTとする。

[0057]
In this embodiment, the number of the fluorescent images which perform a motion-compensation process and an integrating process is set up beforehand.

This number is set to m.

(While, m is an integer 2 or more)

For simplicity, the number n of lines of the constructor which performs the motion-compensation process in fluorescent image-processing-device 24b and an integrating process is made equal to m.

Moreover, the time interval at which the

fluorescent image is input into multiplexer 66 is set to T.

【００５８】
ある時刻ｔ０において、マルチプレクサ６６に入力された蛍光画像は、第１系統の動き補償および積算を実行するための基本画像としてフレームメモリ(1)５３-1に記憶される。次のタイミングで入力される蛍光画像、すなわち時刻ｔ０＋Ｔにおいてマルチプレクサ６６に入力された蛍光画像は、フレームメモリ(1)５３-1の基本画像に対する被動き補償画像としてフレームメモリ(1)５４-1に記憶されると共に、第２系統の動き補償および積算を実行するための基本画像としてフレームメモリ(2)５３-2に記憶される。

[0058]
At a certain time t0, the fluorescent image input into the multiplexer 66 is stored in frame-memory (1) 53-1 as a basic image for performing the 1st-line motion compensation and integrating.
The fluorescent image input at the following timing, i.e., fluorescent image input into the multiplexer 66 at time t0 +T, while frame-memory (1) 54-1 stores as a motion-compensated image opposing to frame-memory (1) 53-1 basic image, frame-memory (2) 53-2 stores as basic image for performing the motion compensation of the second system, and integrating.

【００５９】
次に、時刻ｔ０＋２Ｔにおいてマルチプレクサ６６に入力された蛍光画像は、フレームメモリ(1)５３-1およびフレームメモリ(2)５３-2の基本画像に対する被動き補償画像として、それぞれフレームメモリ(1)５４-1および、フレームメモリ(2)５４-2に記憶されると共に、第３系統の動き補償および積算を実行するための基本画像としてフレームメモリ(3)５３-3に記憶される。

[0059]
Next, the fluorescent image input into the multiplexer 66 at time t0 +2T, while frame-memory (1) 54-1 and frame-memory (2) 54-2 respectively store as motion-compensated image opposing to frame-memory (1) 53-1 and a frame-memory (2) 53-2 basic image, frame-memory (3) 53-3 stores as a basic image for performing the motion compensation of the 3rd system, and integrating.

【００６０】
なおこのとき、フレームメモリ(1) ５４-1に時刻ｔ０ ＋２Ｔの被動き補償画像が記憶される前に、時刻ｔ０ ＋Ｔにおいてフレームメモリ(1) ５４-1 に記憶されていた被動き補償画像には、動き補償回路(1) ５５-1 によって動き補償処理が施される。この動き補償実施後の画像はフレームメモリ(1) ５７-1 に記憶された後、積分回路(1) ５６-1 によって初めはフレームメモリ(1) ５３-1 の基本画像が記憶されているフレームメモリ(1) ５８-1 の画像に積算される。

[0060]
In addition, in frame-memory (1) 54-1 at this time, before storing the motion-compensated time t0 +2T image, a motion-compensation process is performed to the motion-compensated image stored in frame-memory (1) 54-1 at time t0 +T by motion-compensation circuit (1) 55-1.

After the image after this motion-compensation enforcement was stored in frame-memory (1) 57-1, integrating is carried out to the frame-memory (1) 58-1 image by which the frame-memory (1) 53-1 basic image is stored by integration-circuit (1) 56-1 initially.

【００６１】
以上に示したような動作が、時刻ｔ ０ ＋３Ｔ， ｔ ０ ＋４Ｔ，・・・，ｔ０ ＋ｋＴ，・・・（ｋは１以上の整数）について繰り返される。そして、ｋ＝ｍとなった時点で、フレームメモリ(1) ５８-1 に蓄積された蛍光画像はマルチプレクサ６７を介して出力される。

[0061]
An operation which was shown above is time t0+3T, t0 +4T, ***, t0 +kT. *** (k is an integer one or more).

And, when set to k=m, the fluorescent image by which storage was carried out to frame-memory (1) 58-1 is output via multiplexer 67.

【００６２】
フレームメモリ(1) ５８-1 より蛍光画像が出力されると、フレームメモリ(1)５３-1 及び(1) ５８-1 は、時刻ｔ０ の基本画像から時刻ｔ ０ ＋ｍＴの蛍光画像へ基本画像が書き換えられる。

[0062]
If a fluorescent image is output from frame-memory (1) 58-1, as for frame-memory (1)53-1 and (1) 58-1, a basic image will be rewritten from the time t0 basic image to the fluorescent image of time t0 +mT.

The signal line on which this performs the 1st-

これは、第１系統の動き補償処理及び積分処理を実行する信号ラインは第１回目の画像積分処理を終了し、処理後の蛍光画像を出力して第２回目の処理のための基本画像を取り込んだことに相当する。

line motion compensation process and an integrating process completes 1st image integral process.

It is equivalent to having output the fluorescent image after a process and having received the basic image for the 2nd process.

【００６３】

第２系統においては、第１系統と同様の動作が時間Ｔだけ遅れたタイミングで実行される。よって、時刻ｔ０＋（ｍ＋１）Ｔにおいては、第２系統の動き補償処理及び積分処理を実行する信号ラインが第１回目の画像積分処理を終了し、フレームメモリ(2) ５８-2 に蓄積された蛍光画像がマルチプレクサ６７を介して出力され、フレームメモリ(2) ５３-2 及び(2) ５８-2 は、時刻ｔ ０ ＋Ｔの基本画像から時刻ｔ０ ＋（ｍ＋１）Ｔの蛍光画像へ基本画像が書き換えられる。

[0063]

In the second system, the same operation as for the 1st line is performed at the timing slower by time T.

Therefore, at time t0 +(m+1)T, the signal line which performs a motion compensation process and an integrating process of a second system completes an image integral process which is the 1st time.

The fluorescent image by which storage was carried out is output to frame-memory (2) 58-2 via a multiplexer 67.

As for frame-memory (2) 53-2 and (2) 58-2, the basic image is rewritten from time t0 +T basic image to the fluorescent image of time t0 +(m+1)T.

【００６４】

以上のような動作を、さらに繰り返すことによって、動き補償処理及び積分処理を施す蛍光画像の数（画像積算数）がｍの場合はｎ系統（ｍ＝ｎ）の信号ラインを用いることにより、時間間隔Ｔの蛍光画像入力に対して、蛍光画像出力も時間間隔Ｔで行うことが可能になる。すな

[0064]

It is using n signal lines (m=n), when the number of the fluorescent images which perform a motion compensation process and an integrating process by repeating the above operations further (the number of image integrating) is m.

The fluorescent image output can also be performed by time-interval T to the fluorescent image input of time-interval T.

わち、蛍光画像の動き補償処理及び積分処理を実行する信号ラインが１系統しかない場合において積分処理を行った蛍光画像の出力間隔となるｍＴよりも短い時間間隔で蛍光画像を出力することができることになる。これにより、複数の蛍光画像を積算する積分処理を行った場合においても蛍光画像の入力時間間隔と同じ時間間隔で積分処理を施した蛍光画像を出力することができ、画像表示の時間分解能を処理前と同様に維持することができる。

That is, when the signal line which performs a motion compensation process and an integrating process of a fluorescent image does not spread 1 line, a fluorescent image can be output by the time interval shorter than mT used as the output space of the fluorescent image which performed the integrating process.

When this performs an integrating process which integrates some fluorescent images, the same fluorescent image as the input time interval of a fluorescent image which performed the integrating process at intervals can be output.

It is maintainable similar to before processing the temporal resolution of the image display.

【００６５】

各系統のレベル検出回路(n) ５９-n は、第１実施例と同様にフレームメモリ(n) ５８-n に蓄積された蛍光画像の信号レベルを検出し、検出結果に応じて例えば蛍光画像が所定のレベル以上となったときにビデオ切換え制御信号をビデオスイッチングコントローラ２８へ出力する。このビデオ切換え制御信号により、ビデオスイッチングコントローラ２８によってビデオスイッチャ２６におけるビデオ信号の切換えが制御され、マルチプレクサ６７からの蛍光画像をビデオスイッチャ２６において最終的な蛍光観察画像信号として出力したり、通常観察画像表示と蛍光観察画像表示の切換えを

[0065]

Level detector-circuit (n) 59-n of each system detects the signal level of the fluorescent image by which storage was carried out to frame-memory (n) 58-n like in the 1st embodiment.

In response to a detection result, for example, the fluorescent image becomes more than a predetermined level, a video change control signal is output to the video switching controller 28.

A change of the video signal in the video switcher 26 is controlled by this video change control signal by the video switching controller 28.

The fluorescent image from a multiplexer 67 is output as a final fluorescent observation image signal in the video switcher 26.

Moreover, a change of a usual observation image display and fluorescent observation image display can be performed.

行ったりすることができる。

【００６６】
ところで、動き補償処理及び積分処理を実行する際に、画像積算数ｍと信号ラインの系統数ｎとを等しくすると、ハードウェアのコストの面で問題になる場合がある。このような場合には、ｍ＞ｎとしてｍ＝ｋｎ（ｋ＝１，２，３，…）の関係を満たすようにｍ，ｎを設定し、画像表示の適度な時間分解能を維持する方法が考えられる。例えばｍ＝４，ｎ＝２とした場合の、積分処理にかかる蛍光画像処理装置２４ｂの動作の概念図を図７に示す。簡単のため図４と同様に蛍光画像を１次元信号とみなして表している。

[0066]
When, performing a motion-compensation process and the integrating process by the way, If the number m of integrating images equals the number n of lines of the signal line , it may become a problem with respect to the cost of the hardware.
In such a case, m and n are set up so that m=kn(k=1,2,3...) relationship may be fulfilled for m>n.

How to maintain the moderate temporal resolution of an image display can be considered.

For example, the conceptual diagram of the operation of such fluorescent image-processing-device 24b to the integrating process at the time of being referred to as m= 4 and n= 2 is shown in diagram 7.

For simplicity, like diagram 4, it considers that the fluorescent image is a one-dimensional signal, and it is expressed.

【００６７】
図７の（ａ）のマルチプレクサ６６に入力される蛍光画像のうち、第１系統においては、基本画像（図中Ａで表す）に対して後に入力される被動き補償画像（図中Ｂで表す）は動き補償回路(1) ５５-1 で動き補償処理が施され、図７の（ｂ）のように積分回路(1) ５６-1 によりフレームメモリ(1) ５８-1 において基本画像に被動き補償画像が積

[0067]
Among the fluorescent images input into the multiplexer 66 of (a) of diagram 7, in the 1st line, a basic image (it is expressed with A in the drawing(s)) is received. As for the motion-compensated image (it is expressed with B in the drawing(s)) input afterwards, the motion-compensation process is performed by motion-compensation circuit (1) 55-1.

As shown in (b) of diagram 7, in frame-memory (1) 58-1, integrating of the motion compensation image is carried out to a basic

算される。すなわち、時間間隔Tで入力される蛍光画像が４つずつで動き補償処理が施されて積算され、図７の（ｃ）に示すようにフレームメモリ(1) ５８-１より出力される。

image by integration-circuit (1) 56-1.
That is, the fluorescent image input by time-interval T moves by four at a time, and integrating of the compensation process is performed.

As shown in (c) of diagram 7, it is output from frame-memory (1) 58-1.

【００６８】
第２系統においては、第１系統より２Ｔだけ遅れたタイミングで動き補償回路(2) ５５-2 において動き補償処理が施され、図７の（ｄ）のように積分回路(2) ５６-2 によりフレームメモリ(2) ５８-2 において基本画像に被動き補償画像が積算された後、図７の（ｅ）に示すように蓄積された蛍光画像がフレームメモリ(2) ５８-2 より出力される。

[0068]
In the second system, it is moved by the timing 2 T slower than the 1st line, it is moved in compensating-circuit (2) 55-2, and the compensation process is performed.
As shown in (d) of diagram 7, by integration-circuit (2)56-2, in frame-memory (2) 58-2 After carrying out integrating of the motion-compensated image to the basic image, the fluorescent image by which storage was carried out as shown in (e) of diagram 7 is output from frame-memory (2) 58-2.

【００６９】
フレームメモリ(1) ５８-１ 及びフレームメモリ(2) ５８-2 から出力される蛍光画像は、それぞれマルチプレクサ６７を介してそのまま出力される。従って、図７に示すように、画像の積分処理間隔は４Ｔであるにもかかわらず、２系統の信号ラインの蛍光画像総合出力であるマルチプレクサ６７からの蛍光画像出力は図７の（ｆ）に示すように２Ｔの時間間隔で出力することができる。

[0069]
The fluorescent image output from frame-memory (1) 58-1 and frame-memory (2) 58-2 is respectively output as it is via multiplexer 67.
It follows that, although the integrating process interval of the image is 4T, as shown in diagram 7, the fluorescent image output from the multiplexer 67 which is the fluorescent image synthesis output of two signal lines can be output by the time interval of 2T, as shown in (f) of diagram 7.

【0070】
以上のように、複数系統の動き補償処理及び積分処理を行う構成を備え、蛍光画像の動き補償及び積算の処理を複数の系統で時間をずらしながら行うことにより、画像表示の時間分解能の低下を防止して蛍光画像が大きく動くことを防ぐと共に、蛍光画像の強度を向上させて観察対象部位の蛍光観察画像の画質を向上させることができ、蛍光診断能力を高めることができる。

[0070]
As mentioned above, it has the composition which performs two or more motion compensation processes and an integrating process.

While preventing reduction of the temporal resolution of an image display and the fluorescent image from moving greatly by performing the motion compensation of the fluorescent image, and a process of integrating, by shifting the time in some systems, strength of the fluorescent image can be raised and the image quality of the fluorescent observation image of the site for observation can be raised.

The fluorescent-diagnosis capability can be raised.

【0071】
次に、励起光の強度及び照射間隔を可変とした蛍光観察装置の第１の構成例を図８及び図９に示す。

[0071]
Next, the example of the first composition of the fluorescent observation apparatus which made variable strength and the irradiation interval of excitation light is shown in Fig. 8 and 9.

【0072】
観察対象部位へ励起光を照射して蛍光観察を行う装置では、生体組織からの蛍光は微弱であるため、観察対象部位の蛍光像を撮像するために高感度のカメラが必要であり、また、蛍光画像の信号レベルが低く良好な蛍光観察画像が得られない場合が生じる恐れがある。このような問題点を解決するため、前述の実施例のように積分処理を行って

[0072]
Since the fluorescence from an organism tissue is slight, in order that it may image-pick up the fluorescent image of the site for observation in the apparatus which irradiates excitation light to the site for observation, and performs fluorescent observation, the camera of a high sensitivity is required.

Moreover, , there is a possibility that the case where a good fluorescent observation image is not obtained and the signal level of the fluorescent image is low may arise.

蛍光観察画像の画質を向上させることができるが、蛍光像を得るための励起光の強度を上げて蛍光画像の強度を向上させることも考えられる。励起光の強度を上げると生体組織に損傷を与える恐れがあるため、本例では励起光の強度を変更させるのに連動して励起光の照射間隔を変更させるような構成となっている。

Since such trouble is solved, an integrating process can be performed like the above-mentioned embodiment, and the image quality of fluorescent observation image can be raised.

However, raising strength of the excitation light for obtaining the fluorescent image, and raising strength of the fluorescent image is also considered.

Since there is a possibility that damage may be done to an organism tissue when raising strength of the excitation light, in this example, it is the composition of making strength of excitation light altering being interlocked with, and altering the irradiation interval of the excitation light.

【００７３】

蛍光観察装置は、図８に示すように、励起光を発生する励起光源７１と、励起光源７１から出射される励起光の強度を制御する励起光出力制御手段としての出力制御部７２とを備え、観察対象部位の生体組織７３へ励起光を照射するようになっている。また、蛍光像を撮像するためのイメージインテンシファイア等を有する高感度カメラ７４と、高感度カメラ７４で撮像された蛍光画像に係る信号処理を行う蛍光画像処理部７５と、蛍光画像処理部７５で生成された蛍光観察画像を表示するモニタ等の表示手段７６とを有し、生体組織７３からの蛍光を高感度カメラ７４で撮像し、蛍光画像

[0073]

The fluorescent observation apparatus is equipped with the excitation source 71 which generates excitation light, and the output control part 72 as excitation-light output control means to control strength of the excitation light by which a radiation is carried out from a excitation source 71 as shown in diagram 8.

Excitation light is irradiated to the organism tissue 73 of the site for observation, moreover, the high-sensitivity camera 74 which has an image intensifier for image-picking up a fluorescent image etc., the fluorescent image-processing part 75 which performs the signal processing based on the fluorescent image recorded with the high-sensitivity camera 74, display means 76, such as the monitor which displays the fluorescent observation image formed in the fluorescent image-processing part 75. It has these.

処理部７５で信号処理を行って得られた蛍光観察画像を表示手段７６に表示するようになっている。さらに、各部の動作タイミングを制御する同期手段としてのタイミングコントローラ７７が設けられ、タイミングコントローラ７７によりタイミング制御信号を送出することによって出力制御部７２，高感度カメラ７４，蛍光画像処理部７５における励起光の照射と蛍光画像の信号処理とのタイミングがとられるようになっている。

The fluorescence from the organism tissue 73 is recorded with the high-sensitivity camera 74.

The fluorescent observation image which performs a signal processing and was obtained in the fluorescent image-processing part 75 is displayed for display means 76.

Furthermore, the timing controller 77 as a synchronisation means which controls timing of each part of operation is provided.

The timing of irradiation of the excitation light in the output control part 72, the high-sensitivity camera 74, and the fluorescent image-processing part 75 and the signal processing of a fluorescent image by sending out a timing-control signal by the timing controller 77 is taken.

【００７４】

この構成において、生体組織７３から得られる蛍光強度が低い場合には、出力制御部７２により励起光源７１から出射される励起光の強度を高くして、生体組織７３からの蛍光強度も高くなるようにする。このとき、図９に示すように、励起光の強度を高くするのに伴って励起光を照射する時間間隔ＴもＴ１からＴ２（Ｔ１＜Ｔ２）へと間隔が大きくなるようにする。これにより、生体組織の損傷を防止する。

[0074]

In this composition, when the fluorescence intensity obtained from the organism tissue 73 is low, strength of the excitation light by which a radiation is carried out from a excitation source 71 as for the output control part 72 is made high.

The fluorescence intensity from the organism tissue 73 also becomes high.

At this time, as shown in diagram 9, also in time-interval T which irradiates excitation light in connection with making strength of the excitation light high, the interval becomes large from T1 to T2 (T1 <T2).

This prevents damage of an organism tissue.

【００７５】

このように生体組織へ照射する励起光の強度を高めると共に励

[0075]

Thus without doing damage to an organism tissue by enlarging the irradiation interval of

起光の照射間隔を大きくすることにより、生体組織に損傷を与えることなく強度の強い蛍光を得て蛍光画像の信号レベルを高めることができ、蛍光観察画像の画質を向上させて診断精度を向上させることが可能となる。

excitation light, while raising strength of the excitation light irradiated to an organism tissue, the fluorescence with high strength can be obtained and the signal level of the fluorescent image can be raised.

The image quality of fluorescent observation image can be raised and diagnostic accuracy can be raised.

【００７６】

次に、励起光の強度及び照射間隔を可変とした蛍光観察装置の第２の構成例を図１０及び図１１に示す。

[0076]

Next, the example of 2nd composition of the fluorescent observation apparatus which made variable strength and the irradiation interval of excitation light is shown in Figs. 10 and 11.

【００７７】

本例は図８に示した第１の構成例の変形例であり、蛍光観察と通常の照明光による観察とを行う蛍光観察装置における構成例である。

[0077]

The example of this is a modification of the example of first composition shown in diagram 8.

It is an example of composition in the fluorescent observation apparatus which performs fluorescent observation and the observation by the usual illumination light.

【００７８】

本例の蛍光観察装置は、図８の構成に加えて、白色照明光等の通常観察を行うための照明光を発生する照明光源８１と、この通常観察用の照明光による被写体像を撮像する通常観察カメラ８２と、通常観察カメラ８２で撮像された画像に係る信号処理を行う通常画像処理部８３とを有しており、観察対象部位の生体組織７３へ照明光源８１から

[0078]

The fluorescent observation apparatus of the example of this is added to the composition in the diagram 8.

It has the illumination light source 81 which generates the illumination light for performing a usual observation of a white illumination light etc., the usual observation camera 82 which records the copied object image by the illumination light for this usual observation, and the usual image-processing part 83 which performs the signal processing based on the

の通常観察用の照明光を照射し、生体組織７３の通常観察画像を得るようになっている。そして、励起光あるいは通常観察用の照明光による観察対象部位の像の出力先を切換える受光切換手段８４（例えば図１の受光用アダプタ１２と同様の構成）が設けられ、受光切換手段８４により観察対象部位の蛍光像が高感度カメラ７４へ、通常観察像が通常観察カメラ８２へそれぞれ導かれて撮像されるようになっている。蛍光画像処理部７５と通常画像処理部８３の出力側は、表示切換手段８５に接続され、蛍光観察画像及び通常観察画像が表示切換手段８５によって切換えられて表示手段７６へ送出されるようになっている。

image recorded with the usual observation camera 82.

The illumination light for the usual observation from the illumination light source 81 is irradiated to the organism tissue 73 of the site for observation, and the usual observation image of the organism tissue 73 is obtained.

And, light-receiving switching means 84 which switches the output destination of the image of the site for observation by excitation light or the illumination light for a usual observation. (For example, diagram 1 the same composition as adaptor 12 for light-receiving.)

These are provided.

The fluorescent image of the site for observation is guided, and a usual observation image is respectively guided to the high-sensitivity camera 74 by light-receiving switching means 84 to the usual observation camera 82, and it records.

The output side of the fluorescent image-processing part 75 and the usual image-processing part 83 is connected to display switching means 85.

A fluorescent observation image and a usual observation image are switched by display switching means 85, and it is sent out to display means 76.

【００７９】

また、各部の動作タイミングを制御するタイミングコントローラ７７は、出力制御部７２，照明光源８１，受光切換手段８４へタイミング制御信号を送出し、励起光及び通常観察用照明

[0079]

Moreover, the timing controller 77 which controls timing of each part of operation, a timing-control signal is sent out to the output control part 72, the illumination light source 81, and light-receiving switching means 84.

The timing of the signal processing of the

光の照射タイミングと蛍光画像及び通常観察像の信号処理のタイミングとをとるようになっている。

irradiation timing of excitation light and the usual illumination light for observation, a fluorescent image, and a usual observation image is taken.

【0080】

この構成において、生体組織73から得られる蛍光強度が低い場合には、前述の第1の構成例と同様に出力制御部72により励起光源71から出射される励起光の強度を高くして、生体組織73からの蛍光強度も高くなるようにし、これに伴って励起光を照射する時間間隔も大きくする。そして、蛍光画像と通常画像とを交互に観察するときには、図11に示すように、励起光照明タイミングの間隔の伸長に応じて、蛍光観察画像の取り込みタイミングの間隔を変化させ、蛍光観察画像を取り込む時間間隔が大きくなるようにする。例えば、励起光の強度を高くしない場合に1／30 sec 毎に励起光を照射して蛍光観察画像を取り込むとすると、励起光の強度を高くしたときは強度に応じて1／30 sec の整数倍（図11では2倍の1／15 sec ）の間隔で取り込み、蛍光観察画像の時間間隔を1／30 sec の整数倍で大きくする。

[0080]

When the fluorescence intensity obtained from the organism tissue 73 in this composition is low, strength of the excitation light by which a radiation is carried out from a excitation source 71 like the above-mentioned example of first composition as for the output control part 72 is made high, and the fluorescence intensity from the organism tissue 73 is also made to become high.

The time interval which irradiates excitation light in connection with this is also enlarged.

And, when observing a fluorescent image and a fluorescent usual image alternately, as shown in diagram 11, the interval of the incorporated timing of fluorescent observation image is changed depending on the extension of the interval of excitation-light illumination timing, and the time interval for receiving the fluorescent observation image becomes large. For example, when strength of excitation light is not made high, every 1/30sec supposing it irradiates excitation light and it receives fluorescent observation image, when making the strength of excitation light high, it is read in integral multiples of 1/30 sec (receiving at intervals of 1/15sec) the double in diagram 11) depending on the strength.

The time interval of the fluorescent observation image is enlarged by integral multiples of 1/30 sec.

【００８１】
このように生体組織へ照射する励起光の強度を高めると共に励起光の照射間隔を大きくし、通常観察画像と交互に得られる蛍光観察画像の時間間隔を間引いて大きくすることにより、生体組織に損傷を与えることなく蛍光強度を高くして蛍光画像の信号レベルを高めることができ、かつリアルタイムで良好な通常の照明光による通常画像と励起光による蛍光画像とを得ることができる。

[0081]
Thus while raising strength of the excitation light which irradiate to an organism tissue, the irradiation interval of excitation light is enlarged.

By thinning out the time interval of a usual observation image and the fluorescent observation image obtained alternately, and enlarging, without doing damage to an organism tissue, the fluorescence intensity can be made high and the signal level of the fluorescent image can be raised.

And the usual image in real-time and with good usual illumination light and the fluorescent image by excitation light can be obtained.

【００８２】
次に、表示モニタ上での蛍光観察画像及び通常観察画像の画像表示の例を図１２に示す。

[0082]
Next, the example of the image display of the fluorescent observation image on a display monitor and a usual observation image is shown in Diagram 12.

【００８３】
白色照明光等を照射して被写体像を観察する通常観察と、生体組織からの蛍光像を観察する蛍光観察とを行う蛍光観察装置においては、表示モニタ上に蛍光観察画像と通常観察画像とを交互に切り換えて表示したり、２つの画像を合成して表示したりなどの画像表示が行われる。

[0083]
In the fluorescent observation apparatus which performs a usual observation which irradiates a white illumination light etc. and observes a copied object image, and fluorescent observation which observes the fluorescent image from an organism tissue, on a display monitor, fluorescent observation image and a usual observation image are switched alternately, and are displayed.

Moreover, the image of two is synthesised and image displayed, etc.

【００８４】

[0084]

本例では、図１２に示すように、（ａ）の蛍光観察画像上において病変部が存在する場合に、正常部位と病変部との境界を（ｂ）の通常観察画像上において境界線９１として合成表示し、通常観察画像に病変部の位置を表示する。

In this example, as shown in Diagram 12, when a disease part exists in the fluorescent observation image of (a), the synthetic display of the boundary of the normal site and the disease part is made as boundary line 91 on the usual observation image of (b).

The position of a disease part is displayed in a usual observation image.

【００８５】

このように画像表示を行うことにより、通常観察画像上で、通常の照明光による観察画像の持つ奥行き感を失うことなく病変部の位置を表示することができ、診断時の視認性を向上させることができる。

[0085]

Thus the position of a disease part can be displayed by performing an image display, without losing the feeling of depth which the observation image by the usual illumination light has in a usual observation image, and the visibility at the time of diagnosis can be raised.

【００８６】

[0086]

【付記】

（１）　観察対象部位の蛍光を得るための励起光を発生する蛍光観察用光源手段と、前記蛍光観察用光源手段からの励起光による励起に基づく観察対象部位の蛍光観察像を撮像する蛍光観察用撮像手段とを備え、蛍光観察画像を表示する蛍光観察装置であって、前記蛍光観察用撮像手段より時系列的に得られる複数の蛍光画像間における画像の動き補償を行う画像動き補償手段と、前記画像動き補償手段によって動き補償が施された複数

[Additional remark]

(1) It has fluorescent light-source means for observation to generate the excitation light for obtaining the fluorescence of the site for observation, and fluorescent image-pick-up means for observation to image-pick up the fluorescent observation image of the site for observation based on the excitation by the excitation light from above-mentioned fluorescent light-source means for observation.

It is the fluorescent observation apparatus which displays fluorescent observation image.

Comprising, image motion-compensation means to perform the motion compensation of the image between the fluorescent images of

の蛍光画像を積算する積分手段とを有し、前記積分手段によって積算された画像を蛍光観察画像として表示する蛍光観察装置。

some got by the time sequential target from above-mentioned fluorescent image-pick-up means for observation, the integrator which integrates the fluorescent image of some to which the motion compensation was given by the above-mentioned image motion-compensation means It has these.

The fluorescent observation apparatus which displays the image by which integrating was carried out as for the above-mentioned integrator, as fluorescent observation image.

【0087】

（2） 通常の観察用の照明光を発生する通常観察用光源手段と、前記通常観察用光源手段からの照明光による観察対象部位の通常観察像を撮像する通常観察用撮像手段と、観察対象部位の蛍光を得るための励起光を発生する蛍光観察用光源手段と、前記蛍光観察用光源手段からの励起光による励起に基づく観察対象部位の蛍光観察像を撮像する蛍光観察用撮像手段とを備え、蛍光観察画像と通常観察画像とを同時に、あるいは、時分割で切換えて表示する蛍光観察装置であって、前記蛍光観察用撮像手段より時系列的に得られる複数の蛍光画像間における画像の動き補償を行う画像動き補償手段と、前記画像動き補償手段によって動き補償が施された複数の蛍光画像を積算する積分手段とを有し、前記積分手段に

[0087]

(2) Usual light-source means for observation to generate the illumination light for a usual observation, usual image-pick-up means for observation to image-pick up the usual observation image of the site for observation by the illumination light from above-mentioned usual light-source means for observation, fluorescent light-source means for observation to generate the excitation light for obtaining the fluorescence of the site for observation, fluorescent image-pick-up means for observation to image-pick up the fluorescent observation image of the site for observation based on the excitation by the excitation light from above-mentioned fluorescent light-source means for observation.

It has these.

It is the fluorescent observation apparatus which switches and displays fluorescent observation image and a usual observation image by the by time division simultaneously.

Comprising, image motion-compensation means to perform the motion compensation of

よって積算された画像を蛍光観察画像として表示する蛍光観察装置。

the image between the fluorescent images of some got by the time sequential target from above-mentioned fluorescent image-pick-up means for observation, the integrator which integrates the fluorescent image of some to which the motion compensation was given by the above-mentioned image motion-compensation means It has these.

The fluorescent observation apparatus which displays the image by which integrating was carried out as for the above-mentioned integrator, as fluorescent observation image.

【００８８】

（３）　前記画像動き補償手段及び積分手段において、動き補償および積算を施す画像の数が可変である付記（１）に記載の蛍光観察装置。

[0088]

(3) A fluorescent observation apparatus given in the additional remark (1) with the variable number of the images which give the motion compensation and integrating in above-mentioned image motion-compensation means and the above-mentioned integrator.

【００８９】

この構成では、複数の蛍光画像間で動き補償を施した後に、これらの画像を積算した結果を蛍光観察画像として表示する際に、動き補償および積算を施す画像の数を可変とすることにより、観察対象に応じた適切な蛍光観察画像の表示ができ、画質の向上を実現できる。

[0089]

With this composition, after giving the motion compensation among some fluorescent images, in case the result which integrated these images are displayed as fluorescent observation image, the display of a suitable fluorescent observation image can be performed depending on the observation object by making variable the number of the images which give the motion compensation and integrating, and the improvement in image quality is realizable.

【００９０】

（４）　前記画像動き補償手段

[0090]

(4) It has amount detection means of the

あるいは積分手段において処理する蛍光画像の所定の特徴量を検出する特徴量検出手段を備え、この検出された蛍光画像の所定の特徴量に基づいて前記画像動き補償手段及び積分手段において動き補償および積算を施す画像の数を決定する付記（１）に記載の蛍光観察装置。

characteristics to detect the predetermined amount of the characteristics of the fluorescent image processed in above-mentioned image motion-compensation means or the above-mentioned integrator.

A fluorescent observation apparatus given in additional remark (1) which decides the number of the images which give the motion compensation and integrating in above-mentioned image motion-compensation means and the above-mentioned integrator based on the predetermined amount of the characteristics of this detected fluorescent image.

【００９１】

この構成では、得られた観察対象部位の蛍光画像における所定の特徴量に基づいて、画像動き補償手段及び積分手段において動き補償および積算を施す画像の数を決定することにより、観察対象に応じた適切な蛍光観察画像の表示ができ、画質の向上を実現できる。

[0091]

With this composition, the display of a suitable fluorescent observation image can be performed depending on the observation object by deciding the number of the images which give the motion compensation and integrating in image motion-compensation means and an integrator, based on the predetermined amount of the characteristics in the fluorescent image of the obtained site for observation, and the improvement in image quality is realizable.

【００９２】

（５） 前記特徴量検出手段は、前記積分手段の出力における蛍光画像の信号レベルを検出するレベル検出手段からなり、このレベル検出手段によって検出された前記積算された蛍光画像の信号レベルに基づいて前記画像動き補償手段及び積分手段において動き補償および積算を施す

[0092]

(5) Above-mentioned amount detection means of the characteristics consists of level detection means to detect the signal level of a fluorescent image in the output of the above-mentioned integrator.

A fluorescent observation apparatus given in additional remark (4) which decides the number of the images which give the motion compensation and integrating in above-

画像の数を決定する付記（４）に記載の蛍光観察装置。

mentioned image motion-compensation means and the above-mentioned integrator based on the signal level of the above-mentioned fluorescent image by which integrating was carried out detected by this level detection means.

【００９３】
この構成では、積算された蛍光画像の信号レベルに基づいて前記画像動き補償手段及び積分手段によって行う蛍光画像の動き補償および積算を終了することにより、観察対象に応じた所定レベルの良好な蛍光観察画像を得ることができ、診断能力を向上させることができる。

[0093]
With this composition, the good fluorescent observation image of a specified level can be obtained depending on the observation object by completing the motion compensation of the fluorescent image and the integrating which are performed by the above-mentioned image motion-compensation means and the above-mentioned integrator based on the signal level of the fluorescent image by which integrating was carried out, and the diagnostic capability can be raised.

【００９４】
（６） 前記特徴量検出手段は、前記画像動き補償手段において得られる蛍光画像の動きベクトル量を検出する動きベクトル検出手段からなり、この動きベクトル検出手段によって検出された蛍光画像の動きベクトル量に基づいて前記画像動き補償手段及び積分手段において動き補償および積算を施す画像の数を決定する付記（４）に記載の蛍光観察装置。

[0094]
(6) Above-mentioned amount detection means of the characteristics consists of motion vector detection means to detect the motion vector quantity of the fluorescent image obtained in above-mentioned image motion-compensation means.

A fluorescent observation apparatus given in additional remark (4) which decides the number of the images which give the motion compensation and integrating in above-mentioned image motion-compensation means and the above-mentioned integrator based on the motion vector quantity of the fluorescent image detected by this motion vector detection means.

【0095】
この構成では、蛍光画像の動きベクトル量に基づいて画像動き補償手段及び積分手段において動き補償および積算を施す画像の数を決定することにより、蛍光観察用撮像手段で得られた蛍光画像の動きによって検出される蛍光観察用撮像手段を有する内視鏡等の動きに応じた適切な蛍光観察画像の表示ができ、画質の向上を実現できる。

[0095]
With this composition, the display of a suitable fluorescent observation image can perform depending on a motion of the endoscope which has fluorescent image-pick-up means for observation detected by motion of the fluorescent image obtained with fluorescent image-pick-up means for observation, by deciding the number of the images which give the motion compensation and integrating in image motion-compensation means and an integrator based on the motion vector quantity of a fluorescent image.

The improvement in image quality is realizable.

【0096】
（7）　前記動きベクトル検出手段によって検出された蛍光画像の動きベクトル量が所定量をこえた場合に、蛍光画像の動き補償および積算を終了する付記（6）に記載の蛍光観察装置。

[0096]
(7) A fluorescent observation apparatus given in additional remark (6) which completes the motion compensation of a fluorescent image, and integrating when the motion vector quantity of the fluorescent image detected by the above-mentioned motion vector detection means surpasses a predetermined amount.

【0097】
この構成では、蛍光画像の動きベクトル量に基づいて、画像動き補償手段及び積分手段において動き補償および積算を施す画像の数を決定することにより、蛍光観察用撮像手段を有する内視鏡等の先端部の移動速度に応じた適切な蛍光観察画像の表示ができ、蛍光観察用撮像手段を

[0097]
With this composition, the display of a suitable fluorescent observation image can be performed depending on the moving speed of the end, such as the endoscope which has fluorescent image-pick-up means for observation, by deciding the number of the images which give the motion compensation and integrating in image motion-compensation means and an integrator, based on the motion

移動させた場合に予想外の病変部の存在を見逃すことを防止できる。

vector quantity of a fluorescent image.

When making fluorescent image-pick-up means for observation move, it can prevent overlooking existing of an unexpected disease part.

【0098】

(8)　前記動き補償および積算を行う画像動き補償手段と積分手段との組合せを複数具備し、時間間隔Tで取り込まれる前記蛍光観察用撮像手段からの蛍光画像をm枚（ただし、mは2以上の整数）だけ動き補償および積算し、mTよりも短い時間間隔で蛍光観察画像表示の更新を行う付記（1）に記載の蛍光観察装置。

[0098]

(8) Carry out the multiple comprising of the combination of image motion-compensation means and the integrator which perform the above-mentioned motion compensation and above-mentioned integrating.

The fluorescent image from above-mentioned fluorescent image-pick-up means for observation received by time-interval T, m sheets, the motion compensation and integrating is carried out.

(However, m is an integer 2 or more)

A fluorescent observation apparatus given in additional remark (1) shorter than mT which updates the fluorescent observation image display at intervals.

【0099】

この構成では、複数の蛍光画像の積算を行う時間間隔よりも短い時間間隔で蛍光観察画像表示の更新を行うことが可能なように、複数の画像動き補償手段と積分手段との組合せによって動き補償および積算を行うことにより、蛍光画像表示の時間分解能の低下を防止しつつ、蛍光観察画像の画質を向上させることが可能となる。

[0099]

With a time interval shorter than the time interval which performs integrating of some fluorescent images with this composition, and updating the fluorescent observation image display being possible, the image quality of fluorescent observation image can be raised, preventing a reduction of the temporal resolution of a fluorescent image display by performing the motion compensation and integrating with the combination of some image motion-compensation means and an integrator.

【０１００】
（９）　前記画像動き補償手段と積分手段との組合せの数ｎ（ただし、ｎは２以上の整数）と、前記動き補償および積算を施す画像の数ｍとの関係が、ｍ＝ｋｎ（ただし、ｋは１以上の整数）である付記（８）に記載の蛍光観察装置。

[0100]
(9) the number n of the combinations of the above-mentioned image motion-compensation means and the above-mentioned integrator, and for the relationship the number m of the image which gives the above-mentioned motion compensation and above-mentioned integrating, m=kn.
(However, n is an integer two or greater)
(However, k is an integer one or greater) A fluorescent observation apparatus given in this additional remark (8).

【０１０１】
この構成によれば、蛍光画像表示の適度な時間分解能を維持しつつ、蛍光観察画像の画質を向上させることができる。特にｋ＝１の場合には、時間分解能の劣化が全くなくなる。

[0101]
According to this composition, the image quality of the fluorescent observation image can be raised, maintaining the moderate temporal resolution of the fluorescent image display.
At k= 1, deterioration of the temporal resolution is completely eliminated especially.

【０１０２】
（１０）　前記観察対象部位へ照射する励起光の強度及び該励起光を照射する時間間隔を可変する励起光出力制御手段と、前記励起光の照射間隔に合わせて観察対象部位の蛍光観察像を得るように同期をとる同期手段とを備えた付記（１）に記載の蛍光観察装置。

[0102]
(10) Excitation-light output control means with variable time interval which irradiates strength and this excitation light which irradiate to the above-mentioned site for observation, the synchronisation means which takes in synchronization so that it may join at the irradiation interval of above-mentioned excitation light and the fluorescent observation image of the site for observation may be obtained, the fluorescent observation apparatus equipped with these, in additional remark (1).

【０１０３】
この構成では、励起光出力制御

[0103]
In this composition, by this excitation-light

手段によって観察対象部位へ照射する励起光の強度及び励起光を照射する時間間隔を可変させ、可変された励起光の照射間隔に同期して蛍光観察像を検出することによって、生体組織に損傷を与えることなく強度の強い蛍光を得て蛍光画像の信号レベルを高めることができ、蛍光観察画像の画質を向上させることが可能となる。

output control means, it is variable time interval which irradiates strength and the excitation light of excitation light which irradiate to the site for observation.

By the fluorescent observation image detected synchronizing with the irradiation interval of the excitation light made variable, without doing damage to an organism tissue, the fluorescence with strong strength can be obtained and the signal level of a fluorescent image can be raised, and the image quality of fluorescent observation image can be raised.

【０１０４】

[0104]

【発明の効果】

以上説明したように本発明によれば、蛍光画像の強度を向上させて観察対象部位の蛍光観察画像の画質を向上させることができ、これにより診断能力を高めることが可能となる効果がある。

[EFFECT OF THE INVENTION]

As explained above, according to this invention, strength of the fluorescent image can be raised and the image quality of the fluorescent observation image of the site for observation can be raised, and there is an effect which can improve the diagnostic capability by this.

【図面の簡単な説明】

[BRIEF EXPLANATION OF DRAWINGS]

【図１】

図１ないし図３は本発明の第１実施例に係り、図１は蛍光観察装置の全体構成を示す構成説明図

[FIGURE 1]

Fig. 1 or 3 concerns the 1st embodiment of this invention.

Diagram 1 shows the entire composition of fluorescent observation apparatus of a composition explanatory drawing.

【図２】

[FIGURE 2]

生体組織の観察対象部位における蛍光のスペクトラムを示す特性図	The characteristic view showing the fluorescent spectrum in the site for observation of an organism tissue
【図３】	[FIGURE 3]
図１の構成における蛍光画像処理装置の機能構成を示すブロック図	The block diagram showing the function composition of the fluorescent image processing device in the composition in the diagram 1
【図４】	[FIGURE 4]
蛍光画像処理装置における動作を説明するタイムチャート	The time chart explaining the operation in a fluorescent image processing device
【図５】	[FIGURE 5]
本発明の第２実施例に係る蛍光観察装置における蛍光画像処理装置の機能構成を示すブロック図	The block diagram showing the function composition of the fluorescent image processing device in the fluorescent observation apparatus based on the second embodiment of this invention
【図６】	[FIGURE 6]
図６及び図７は本発明の第３実施例に係り、図６は蛍光観察装置における蛍光画像処理装置の機能構成を示すブロック図	Fig. 6 and 7 concerns the 3rd embodiment of this invention. Diagram 6 is a block diagram showing the function composition of the fluorescent image processing device in fluorescent observation apparatus.
【図７】	[FIGURE 7]
蛍光画像処理装置における動作を説明するタイムチャート	The time chart explaining the operation in a fluorescent image processing device
【図８】	[FIGURE 8]
図８及び図９は励起光の強度及び照射間隔を可変とした蛍光観	Fig. 8 and 9 concerns the example of first composition of the fluorescent observation

察装置の第１の構成例に係り、図８は蛍光観察装置の構成を示すブロック図

apparatus which made variable strength and the irradiation interval of excitation light.
Diagram 8 is a block diagram showing the composition of fluorescent observation apparatus.

【図９】
図８の蛍光観察装置における励起光の強度及び照射間隔を示す動作説明図

[FIGURE 9]
Explanatory drawing of operation showing strength and the irradiation interval of the excitation light in the fluorescent observation apparatus in the diagram 8

【図１０】
図１０及び図１１は励起光の強度及び照射間隔を可変とした蛍光観察装置の第２の構成例に係り、図１０は蛍光観察装置の構成を示すブロック図

[FIGURE 10]
Fig. 10 and 11 concerns the example of 2nd composition of the fluorescent observation apparatus which made variable strength and the irradiation interval of excitation light.
Diagram 10 is a block diagram showing the composition of fluorescent observation apparatus.

【図１１】
図１０の蛍光観察装置における励起光の強度及び照明タイミングと画像取り込みタイミングを示す動作説明図

[FIGURE 11]
Explanatory drawing of operation showing strength and the illumination timing and the image incorporation timing of excitation light in the fluorescent observation apparatus in the diagram 10

【図１２】
表示モニタ上での蛍光観察画像及び通常観察画像の画像表示の例を示す作用説明図

[FIGURE 12]
Effect explanatory drawing showing the example of the image display of the fluorescent observation image on a display monitor, and a usual observation image

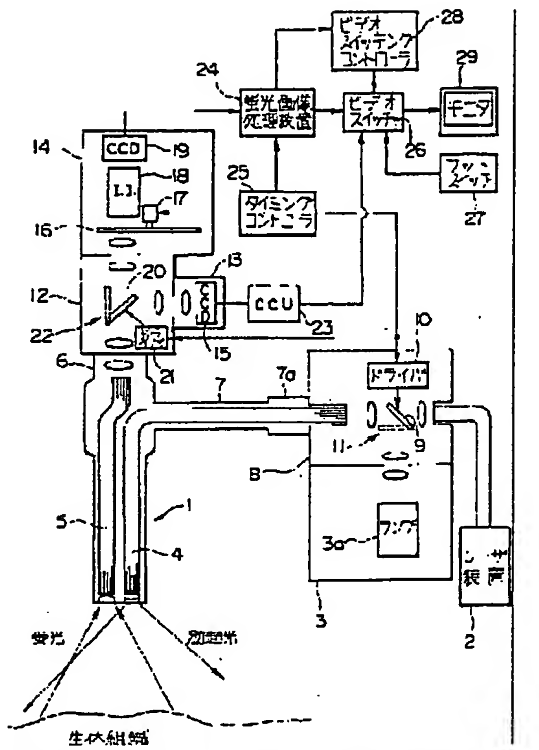
【符号の説明】
１…内視鏡

[EXPLANATION OF DRAWINGS]
1... endoscope

2…レーザ装置	2... laser apparatus
3…ランプ光源装置	3... lamp light source device
8…配光用アダプタ	8... Adaptor for light distributions
１２…受光用アダプタ	12... Adaptor for light receptions
１３…通常観察用カメラ	13... camera for usual observation
１４…蛍光観察用カメラ	14... Fluorescent camera for observation
２３…ＣＣＵ	23...CCU
２４…蛍光画像処理装置	24... fluorescence image processing device
２５…タイミングコントローラ	25... timing controller
２６…ビデオスイッチャ	26... video switcher
２８…ビデオスイッチングコントローラ	28... video switching controller
２９…モニタ	29... monitor
５１…制御部	51... control part
５２…マルチプレクサ	52... multiplexer
５３，５４，５７，５８…フレームメモリ	53,54,57,58... frame memories
５５…動き補償回路	55... motion compensating circuit
５６…積分回路	56... integration circuit
５９…レベル検出回路	59... level detector circuit

【図１】

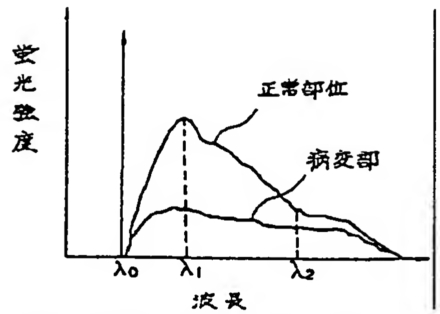
[FIGURE 1]



[translation of Japanese text in Figure 1]
also refer to EXPLANATION OF DRAWINGS

10	driver
21	driver
27	foot switch
30	lamp
below 5	fluorescent light
below 4	excitation light
at bottom	organism tissue

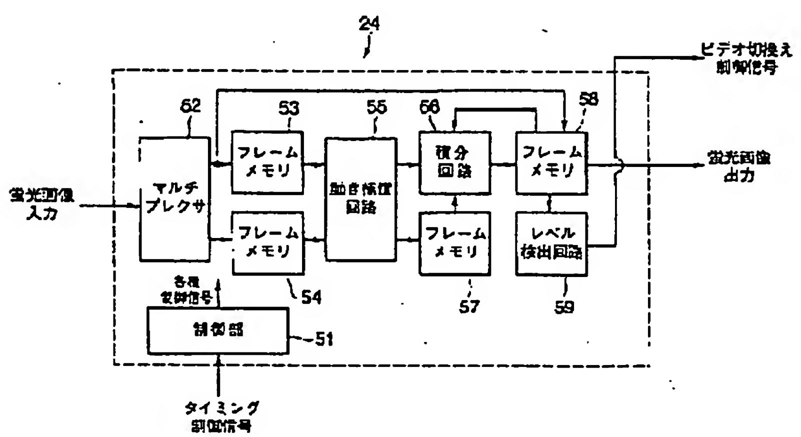
【図２】 **[FIGURE 2]**



[translation of Japanese text in Figure 2]

vertical axis:	fluorescent light strength
horizontal axis:	wavelength
top line:	normal location
bottom line:	diseased location

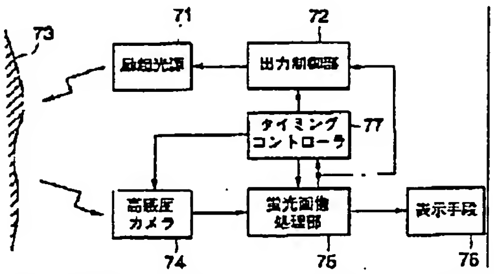
【図３】 **[FIGURE 3]**



[translation of Japanese text in Figure 3]

input to 52	fluorescent image input
input to 51	timing control signal
output to 51	each control signal
output from 58	fluorescent image output
output from 59	video switching control signal

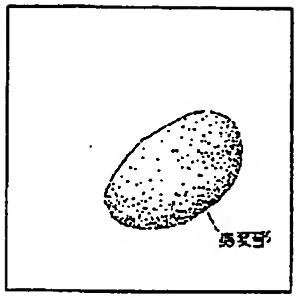
【図８】 [FIGURE 8]



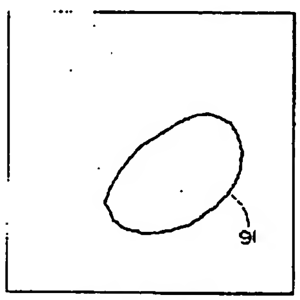
[translation of Japanese text in Figure 8]

71 excitation light
72 output controller
74 highly sensitive camera
75 fluorescent image processor
76 display means
77 timing controller

【図１２】 [FIGURE 12]



(a) 蛍光観察画像



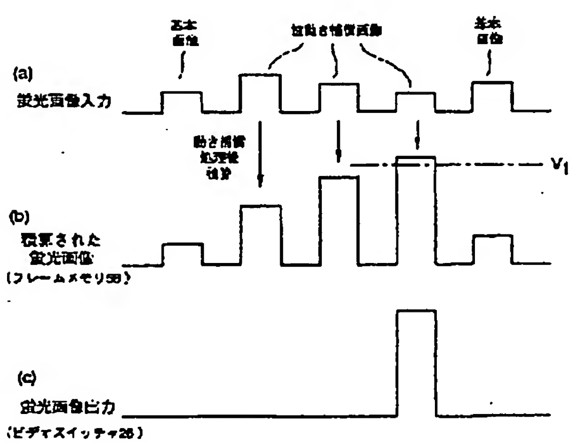
(b) 通常観察画像

[translation of Japanese text in Figure 12]

(a) fluorescent observation image
diseased part

(b) normal observation image

【図４】 **[FIGURE 4]**



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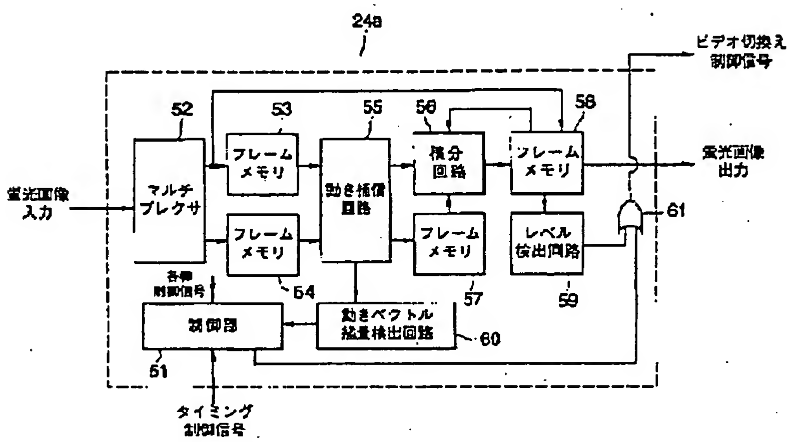
[translation of Japanese text in Figure 4]

(a) fluorescent image input
base image
motion compensated images
base image

(b) integrated fluorescent image (frame memory 58)
integration after motion compensation

(c) fluorescent image output (video switcher 26)

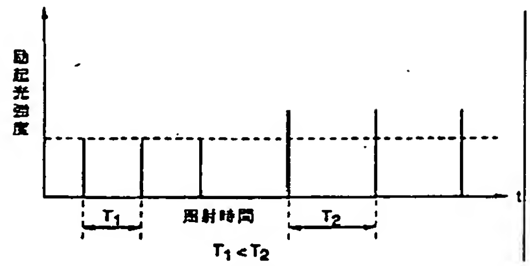
【図5】 **[FIGURE 5]**



[translation of Japanese text in Figure 5]

60	motion vector sum detector circuit
input to 52	fluorescent image input
input to 51	timing control signal
output to 51	each control signal
output from 58	fluorescent image output
output from 61	video switching control signal

【図9】 **[FIGURE 9]**

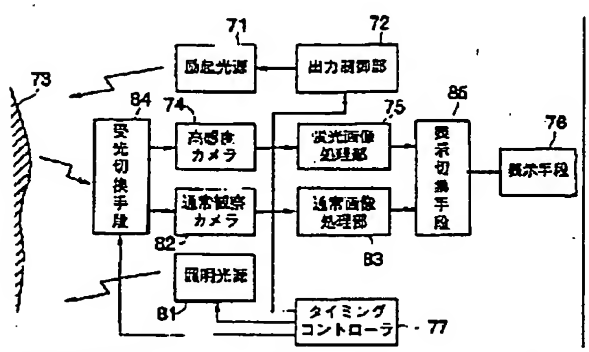


[translation of Japanese text in Figure 9]

vertical axis: excitation light intensity

horizontal axis: duration of irradiation

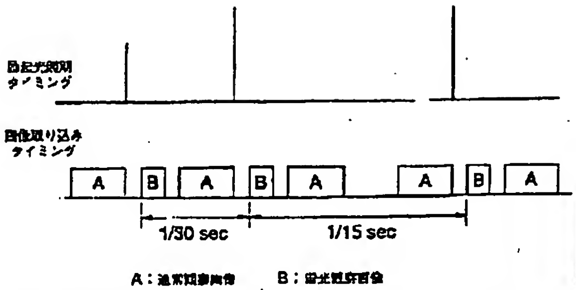
【図１０】 **[FIGURE 10]**



[translation of Japanese text in Figure 10]

71	excitation light source
72	output controller
74	highly sensitive camera
75	fluorescent image processor
76	display means
77	timing controller
81	irradiation light source
82	normal observation camera
83	normal image processor
84	input light switching means
85	display switching means

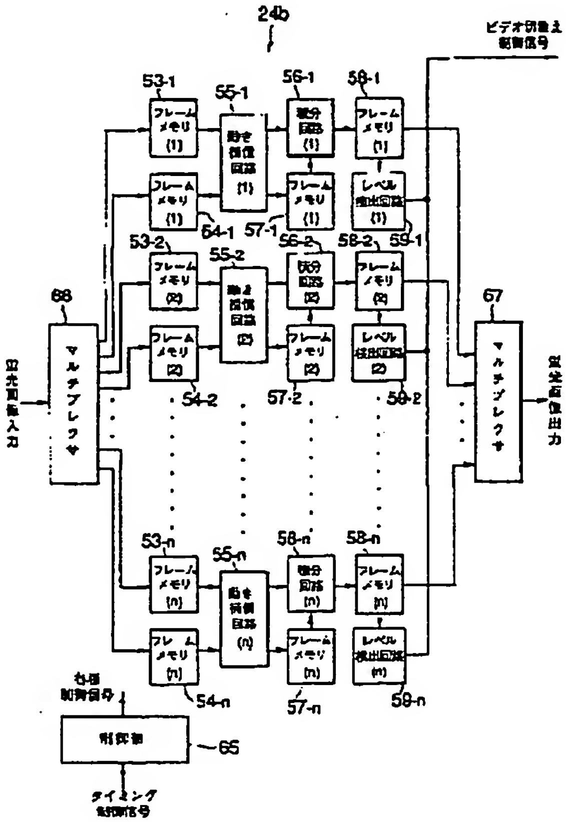
【図１１】 **[FIGURE 11]**



[translation of Japanese text in Figure 11]

top	excitation light irradiation timing
bottom	image read timing
A:	normal observation image
B:	fluorescent observation image

【図６】 **[FIGURE 6]**



[translation of Japanese text in Figure 6]

53-x, 54-x, 57-x, 58-x frame memory (x)

55-x motion compensating circuit-x

56-x integration circuit-x

59-x level detection circuit-x

65 controller

input to 65 timing control signal

66 multiplexer

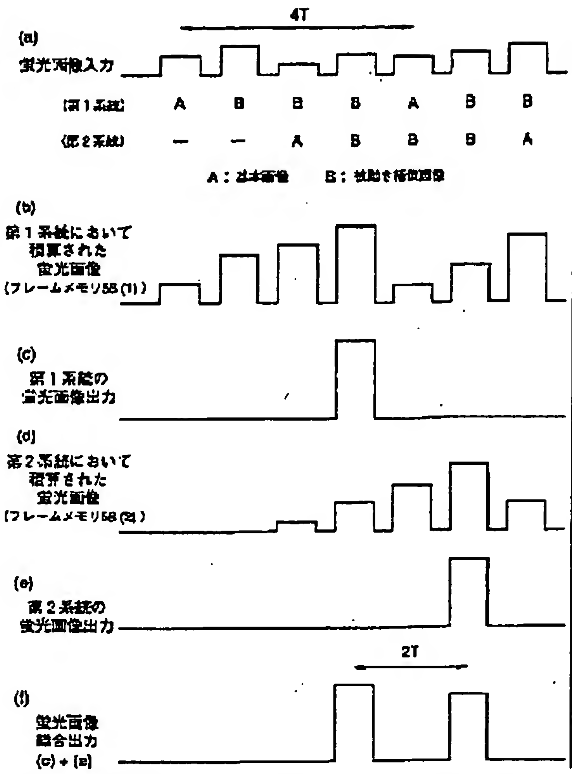
input to 66 fluorescent image input

67 multiplexer

output from 67 fluorescent image output

output from 59-n video switching control signal

【図７】 **[FIGURE 7]**



[translation of Japanese text in Figure 7]

(a)	fluorescent image input
	(1st line)
	(2nd line)
A:	base image
B:	motion corrected image
(b)	fluorescent image integrated from 1st line
	(frame memory (58) 1)
(c)	fluorescent image output from 1st line
(d)	fluorescent image integrated from 2nd line
	(frame memory (58) 2)
(e)	fluorescent image output from 2nd line
(f)	fluorescent image sum output (c) + (e)

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